GRAFTON'S

GRADED ARITHMETIC

BOOK III.

BY

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MONTREAL.

Authorized for use in the Province of Quebec.

PRICE, 15 CENTS.

MONTREAL:
F. E. GRAFTON & SONS, PUBLISHERS.
1899.

NOTE TO TEACHERS.

This collection of exercises has been arranged and compiled for the use of young pupils. It is intended to furnish a sufficient number of easy and easily graded examples. It has been prepared for inductive teaching. New work is introduced by easy sight examples, the object being to lead to an almost unaided perception of processes and principles. Too often young pupils have to grapple with numerical difficulties when attempting to grasp a new principle.

Many of the problems are new; others have been collected at various times during the past twenty years from sources too numerous to specify. The merit of the work (if it has any) does not consist in the originality of its matter, but in its arrangement and grading.

Nothing is so discouraging to teachers of arithmetic as the ease with which pupils forget. For this reason, though the ordinary arrangement by topics has been adopted as best calculated in the first instance to impress upon the mind a new principle and rule, one-third of the book is taken up with review and test examples, and with exercises intended to secure rapidity and accuracy in the simple rules and other computations. These exercises should be taken as occasion demands.

The author desires to express his indebtedness to Mr. Nevil Norton Evans, M.A.Sc., Lecturer in Chemistry, McGill College, for revising the section on the Metric System.

A **Teachers' Manual,** giving full directions in using this book, as well as **Answers** to examples, may be procured from the Publishers. Price, 35 cents.

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I.

Work by shortest method:—

A (*Sight*).

1. $\frac{1}{2} + \frac{1}{3}$.
2. $\frac{1}{7} + \frac{1}{3}$.
3. $\frac{1}{4} + \frac{1}{5}$.
4. $\frac{1}{3} + \frac{1}{6}$.
5. $\frac{1}{6} + \frac{1}{9}$.
6. $\frac{1}{5} + \frac{1}{12}$.
7. $\frac{1}{2} + \frac{1}{5}$.
8. $\frac{1}{6} + \frac{1}{7}$.
9. $\frac{1}{4} + \frac{1}{8}$.
10. $\frac{1}{8} + \frac{1}{7}$.
11. $\frac{1}{5} + \frac{1}{9}$.
12. $\frac{1}{8} + \frac{1}{9}$.
13. $\frac{1}{8} + \frac{1}{12}$.
14. $\frac{1}{7} + \frac{1}{12}$.
15. $\frac{1}{5} + \frac{1}{11}$.
16. $\frac{1}{7} + \frac{1}{6}$.
17. $\frac{1}{4} + \frac{1}{6}$.
18. $\frac{1}{6} + \frac{1}{12}$.
19. $\frac{1}{3} - \frac{1}{4}$.
20. $\frac{1}{3} - \frac{1}{9}$.
21. $\frac{1}{2} - \frac{1}{6}$.
22. $\frac{1}{2} - \frac{1}{6}$.
23. $\frac{1}{5} - \frac{1}{6}$.
24. $\frac{1}{4} - \frac{1}{9}$.
25. $\frac{1}{4} - \frac{1}{7}$.
26. $\frac{1}{3} - \frac{1}{7}$.
27. $\frac{1}{3} - \frac{1}{5}$.
28. $\frac{1}{2} - \frac{1}{5}$.
29. $\frac{1}{2} - \frac{1}{4}$.
30. $\frac{1}{2} - \frac{1}{3}$.
31. $\frac{1}{5} - \frac{1}{9}$.
32. $\frac{1}{8} - \frac{1}{9}$.
33. $\frac{1}{9} - \frac{1}{12}$.
34. $\frac{1}{11} - \frac{1}{12}$.
35. $\frac{1}{5} - \frac{1}{10}$.
36. $\frac{1}{10} - \frac{1}{11}$.

B (*Sight*).

1. $\frac{1}{4} + \frac{3}{5}$.
2. $\frac{1}{3} + \frac{4}{5}$.
3. $\frac{1}{2} + \frac{2}{3}$.
4. $\frac{1}{2} + \frac{3}{5}$.
5. $\frac{3}{7} + \frac{2}{5}$.
6. $\frac{3}{5} + \frac{2}{3}$.
7. $\frac{3}{5} + \frac{3}{4}$.
8. $\frac{2}{3} + \frac{3}{4}$.
9. $\frac{1}{5} + \frac{3}{4}$.
10. $\frac{1}{4} + \frac{4}{5}$.
11. $\frac{2}{9} + \frac{5}{6}$.
12. $\frac{2}{3} + \frac{4}{9}$.
13. $\frac{3}{4} + \frac{5}{6}$.
14. $\frac{3}{4} + \frac{5}{7}$.
15. $\frac{4}{9} + \frac{5}{7}$.
16. $\frac{2}{3} - \frac{1}{2}$.
17. $\frac{2}{3} - \frac{1}{4}$.
18. $\frac{3}{4} - \frac{2}{3}$.
19. $\frac{2}{5} - \frac{1}{3}$.
20. $\frac{3}{5} - \frac{1}{2}$.
21. $\frac{4}{5} - \frac{2}{3}$.
22. $\frac{3}{4} - \frac{1}{8}$.
23. $\frac{3}{7} - \frac{1}{6}$.
24. $\frac{2}{3} - \frac{3}{7}$.
25. $\frac{5}{9} - \frac{1}{3}$.
26. $\frac{5}{7} - \frac{1}{4}$.
27. $\frac{4}{7} - \frac{1}{2}$.
28. $\frac{5}{7} - \frac{5}{8}$.
29. $\frac{2}{5} - \frac{1}{8}$.
30. $\frac{7}{8} - \frac{3}{5}$.

C

1. $24\frac{8}{9} + 13\frac{1}{2}$.
2. $35\frac{2}{3} + 17\frac{1}{2}$.
3. $25\frac{3}{4} + 48\frac{3}{8}$.
4. $54\frac{3}{5} + 28\frac{2}{3}$.
5. $36\frac{3}{4} + 64\frac{2}{5}$.
6. $36\frac{4}{7} + 37\frac{3}{4}$.
7. $54\frac{2}{7} + 15\frac{4}{5}$.
8. $28\frac{2}{3} + 27\frac{5}{9}$.
9. $23\frac{5}{8} + 18\frac{3}{4}$.
10. $19\frac{8}{10} + 18\frac{2}{5}$.
11. $14 - \frac{2}{3}$.
12. $35 - \frac{7}{6}$.
13. $10 - \frac{4}{11}$.
14. $36 - \frac{7}{10}$.
15. $20 - 8\frac{4}{5}$.
16. $20 - 8\frac{7}{12}$.
17. $44 - 13\frac{5}{8}$.
18. $69\frac{5}{16} - 14\frac{5}{8}$.
19. $50\frac{4}{11} - 20\frac{3}{4}$.
20. $52\frac{7}{9} - 39\frac{1}{9}$.
21. $5\frac{1}{8} - 2\frac{4}{5}$.
22. $9\frac{1}{4} - 8\frac{5}{6}$.
23. $8\frac{2}{3} - 2\frac{3}{4}$.
24. $7\frac{1}{2} - 4\frac{1}{6}$.
25. $3\frac{1}{2} - 2\frac{5}{8}$.
26. $9\frac{1}{3} - 4\frac{1}{2}$.
27. $6\frac{3}{8} - 1\frac{2}{3}$.
28. $4\frac{3}{4} - 2\frac{5}{6}$.
29. $6\frac{7}{8} - 1\frac{9}{10}$.
30. $6\frac{9}{11} - 5\frac{3}{7}$.

D (*Sight*).

1. $\frac{3}{5} \times 5$.
2. $\frac{3}{5} \times 10$.
3. $\frac{8}{15} \times 5$.
4. $\frac{9}{16} \times 2$.
5. $\frac{9}{16} \times 8$.
6. $\frac{9}{16} \times 12$.
7. $\frac{7}{33} \times 11$.
8. $\frac{7}{33} \times 7$.
9. $\frac{1}{21} \times 7$.
10. $\frac{16}{35} \times 7$.
11. $\frac{4}{5} \times 7$.
12. $\frac{5}{16} \times 6$.
13. $\frac{3}{4} \times 12$.
14. $\frac{5}{7} \times 21$.
15. $\frac{3}{5} \times 16$.
16. $\frac{5}{9} \times 18$.
17. $\frac{4}{5} \times 20$.
18. $\frac{5}{9} \times 90$.
19. $\frac{11}{42} \times 6$.
20. $\frac{13}{20} \times 15$.
21. $\frac{7}{15} \times 12$.

E (*Sight*).

1. $\frac{6}{13} \div 3$.
2. $\frac{6}{13} \div 6$.
3. $\frac{6}{13} \div 9$.
4. $\frac{21}{32} \div 3$.
5. $\frac{21}{32} \div 7$.
6. $\frac{11}{13} \div 2$.
7. $\frac{11}{13} \div 3$.
8. $\frac{3}{4} \div 8$.
9. $\frac{4}{5} \div 2$.
10. $\frac{5}{6} \div 5$.
11. $1\frac{3}{7} \div 5$.
12. $1\frac{3}{7} \div 7$.
13. $8\frac{1}{3} \div 5$.
14. $8\frac{1}{3} \div 10$.
15. $2\frac{5}{11} \div 9$.
16. $2\frac{5}{11} \div 4$.
17. $5\frac{1}{4} \div 7$.
18. $1\frac{1}{99} \div 10$.
19. $3\frac{3}{11} \div 4$.
20. $3\frac{4}{5} \div 8$.
21. $\frac{4}{11} \div 9$.
22. $\frac{7}{9} \div 2$.
23. $\frac{3}{8} \div 4$.
24. $\frac{2}{3} \div 6$.
25. $\frac{3}{7} \div 6$.
26. $\frac{6}{7} \div 9$.
27. $6\frac{1}{2} \div 4$.
28. $3\frac{1}{3} \div 7$.
29. $6\frac{2}{5} \div 5$.
30. $2\frac{1}{9} \div 3$.

F

1. $8\frac{3}{4} \times 3$.	11. $16 \times \frac{3}{5}$.	21. $101 \times 2\frac{1}{2}$.
2. $7\frac{1}{3} \times 9$.	12. $18 \times \frac{5}{6}$.	22. $365 \times 3\frac{1}{3}$.
3. $6\frac{2}{3} \times 8$.	13. $20 \times \frac{4}{5}$.	23. $201 \times 5\frac{3}{7}$.
4. $9\frac{1}{2} \times 7$.	14. $17 \times \frac{8}{9}$.	24. $224 \times 1\frac{1}{8}$.
5. $6\frac{3}{4} \times 6$.	15. $89 \times \frac{1}{2}$.	25. $346 \times 8\frac{5}{6}$.
6. $4\frac{2}{5} \times 5$.	16. $78 \times \frac{2}{3}$.	26. $100 \times 9\frac{5}{7}$.
7. $9\frac{3}{4} \times 8$.	17. $83 \times \frac{3}{8}$.	27. $32 \times 11\frac{3}{5}$.
8. $8\frac{2}{3} \times 6$.	18. $51 \times \frac{2}{7}$.	28. $40 \times 16\frac{7}{8}$.
9. $6\frac{3}{5} \times 5$.	19. $63 \times \frac{4}{5}$.	29. $36 \times 15\frac{4}{5}$.
10. $5\frac{1}{2} \times 4$.	20. $42 \times \frac{2}{7}$.	30. $20 \times 15\frac{1}{5}$.

G

1. $19\frac{1}{2} \div 3$.	8. $22\frac{1}{4} \div 5$.	15. $230\frac{1}{2} \div 6$.
2. $16\frac{4}{5} \div 4$.	9. $65\frac{1}{3} \div 9$.	16. $321\frac{1}{3} \div 8$.
3. $16\frac{2}{3} \div 7$.	10. $57\frac{5}{9} \div 2$.	17. $101\frac{2}{5} \div 9$.
4. $12\frac{4}{5} \div 5$.	11. $315\frac{1}{3} \div 2$.	18. $216\frac{1}{4} \div 7$.
5. $24\frac{2}{3} \div 8$.	12. $213\frac{1}{2} \div 3$.	19. $321\frac{2}{5} \div 8$.
6. $19\frac{3}{7} \div 6$.	13. $321\frac{1}{2} \div 3$.	20. $514\frac{3}{8} \div 5$.
7. $17\frac{4}{5} \div 9$.	14. $622\frac{1}{4} \div 5$.	21. $213\frac{4}{5} \div 5$.

II.

A **complex fraction** has a fraction in either its numerator or denominator, or in both.

Reduce to simple fractions :—

1. $\frac{3\frac{1}{2}}{7}$	2. $\frac{4\frac{1}{4}}{34}$	3. $\frac{12}{1\frac{1}{2}}$	4. $\frac{15}{3\frac{4}{7}}$	5. $\frac{\frac{3}{4}}{5}$	6. $\frac{3}{\frac{4}{5}}$

7. $\frac{\frac{6}{7}}{8}$ 8. $\frac{6}{\frac{7}{8}}$ 9. $\frac{\frac{2}{3}}{\frac{5}{6}}$ 10. $\frac{\frac{8}{9}}{\frac{14}{15}}$ 11. $\frac{\frac{8}{15}}{\frac{9}{20}}$ 12. $\frac{9\frac{5}{8}}{\frac{11}{16}}$

13. $\frac{\frac{17}{20}}{13\frac{3}{10}}$ 14. $\frac{6\frac{8}{11}}{\frac{19}{22}}$ 15. $\frac{7\frac{3}{5}}{2\frac{4}{15}}$ 16. $\frac{52}{3\frac{1}{4}}$ 17. $\frac{15\frac{3}{8}}{7\frac{1}{8}}$ 18. $\frac{251}{\frac{4}{5}}$

19. Find the sum of the 2nd and 3rd examples.
20. Find the difference between the 11th and 12th.
21. Find the product of the 5th and 6th.
22. Find the quotient of the 8th divided by the 9th.

23. $\frac{\frac{2}{3} \times \frac{9}{10}}{\frac{5}{8}}$ 24. $\frac{\frac{15}{22}}{\frac{4}{5} \times \frac{10}{11}}$ 25. $\frac{\frac{3}{5} \text{ of } 13\frac{1}{4}}{\frac{4}{7} \text{ of } 7\frac{7}{8}}$

26. $\frac{5\frac{1}{2} \times \frac{4}{33}}{7\frac{5}{6}}$ 27. $\frac{8 \times 9\frac{3}{8}}{5}$ 28. $\frac{1\frac{3}{20} \times 33\frac{5}{6}}{3\frac{1}{2}}$

29. $\frac{\frac{3}{4} \text{ of } 2\frac{1}{3}}{\frac{9}{10}}$ 30. $\frac{\frac{2}{3} \text{ of } \frac{11}{12}}{\frac{1}{18} \text{ of } 5\frac{1}{2}}$ 31. $\frac{\frac{5}{9} \text{ of } \frac{3}{7}}{\frac{14}{15}}$

32. $\frac{27\frac{17}{24}}{2\frac{43}{45} \times 1\frac{1}{14}}$ 33. $\frac{23}{2\frac{1}{7} \times 2\frac{1}{5}}$ 34. $\frac{12\frac{2}{3} \text{ of } 1\frac{8}{10}}{3\frac{3}{7} \times 1\frac{5}{9}}$

35. $\frac{3\frac{1}{5} \div 1\frac{1}{7}}{\frac{21}{25} \text{ of } 1\frac{2}{3}}$ 36. $\frac{9\frac{1}{3} \times \frac{1}{15}}{2\frac{4}{5} \div 4\frac{1}{2}}$ 37. $\frac{\frac{1}{7} \text{ of } \frac{1}{2}}{3\frac{1}{2} \times 4\frac{1}{2}}$

38. $\frac{13\frac{1}{3} \div 12\frac{3}{4}}{3\frac{3}{4} \div 5\frac{2}{3}}$ 39. $\frac{7\frac{1}{7} \div 3\frac{3}{8}}{4\frac{2}{7} \div 10\frac{1}{8}}$ 40. $\frac{3\frac{3}{5} \times 3\frac{3}{10}}{12\frac{3}{8} \div 6\frac{1}{4}}$

III.

A (*Sight*).

What part (or fraction) of:—

1. 3 is 1?
2. 3 is 2?
3. 7 is 3?
4. 9 is 2?
5. 12 is 4?
6. 8 is 15?
7. 15 is 8?
8. 8 is $\frac{1}{2}$?
9. 7 is $\frac{2}{3}$?
10. $\frac{3}{5}$ is 4?
11. $\frac{4}{5}$ is $\frac{2}{3}$?
12. $\frac{1}{2}$ is $\frac{1}{3}$?
13. $\frac{1}{2}$ is $\frac{1}{5}$?
14. $\frac{3}{4}$ is $\frac{1}{8}$?
15. $\frac{2}{3}$ is $\frac{3}{4}$?

16. What part of 30 cents is 6 cents?
17. What part of 21 yds. is 7 yds.?
18. $12 is what part of $30? Of $96?
19. What part of a foot is 4 inches? 3½ inches?
20. What part of an hour is 15 min.? 40 min.?
21. What part of a year is 4 months? 50 days?
22. What fraction of a yard is 1 ft. 6 in.? 2 ft. 6 in.?
23. Express as the fraction of a century 50 years; 70 years; 20 years; 5 years; 4 years; 2 years.
24. What fractional part of a lb. is $\frac{1}{5}$ of an ounce?
25. What fractional part of 3 wks. 2 dys. is 6 dys.? 15 days? 1 wk. 5 dys.? 2 wks. 4 dys.?
26. Express $\frac{2}{3}$ of a dozen as a fraction of $\frac{1}{5}$ of a score.

B

1. Express 3 pints as a fraction of 12 gallons.
2. Express 3 dys. 16 hrs. as a fraction of 5 weeks.
3. Express 40 seconds as a fraction of 3 hrs. 24 min.
4. What fractional part of £1. is 16s. 8d.?
5. What fractional part of 5 yds. is 7½ inches?
6. What part of a ream is 7 quires 20 sheets?
7. Reduce 3 gal. 1 qt. to the fraction of 36 gallons.

8. What part of \$58 is $\frac{2}{3}$ of \$69?
9. Reduce $\frac{4}{5}$ of 2s. 6d. to the fraction of $\frac{5}{8}$ of £2. 8s.
10. Reduce $\frac{9}{11}$ of a mile to the fraction of 220 yds.
11. Express $1\frac{4}{5}$ as a fraction of $2\frac{1}{4}$.
12. Express $\frac{9}{11}$ of a mile as a fraction of $\frac{1}{8}$ of a mile.
13. Express $\frac{7}{10}$ of a yard as a fraction of an inch.
14. Express $\frac{5}{12}$ of £1. as a fraction of 1s.
15. Express $\frac{5}{6}$ of an acre as a fraction of a sq. rod.
16. Express $\frac{8}{15}$ of a sq. yd. as a fraction of a sq. foot.
17. Express $\frac{11}{14}$ of a cu. foot as a fraction of a cu. inch.
18. What part of 6s. 8d. is 3s. 4d.?
19. What fraction of 10 miles is $2\frac{3}{8}$ miles?
20. What fraction of 3 weeks 2 days is 6 days 8 hrs.?
21. What fraction of 1 yd. 1 ft. 7 in. is 2 yds. 1 ft. 4 in.?
22. Value of $\frac{\text{2 yds. 2 ft. 3 in.}}{\text{9 yds.}}$

C (*Questions 1–13 at sight*).

What decimal fraction of:—

1. 2 is 1?
2. 8 is 2?
3. 12 is 9?
4. 16 is 6?
5. 8 is 7?
6. 15 is 5?
7. $3\frac{1}{2}$ is $\frac{1}{2}$?
8. 20 is 2?
9. \$10 is \$$6\frac{2}{3}$?
10. $\frac{5}{7}$ is $\frac{2}{5}$?
11. $2\frac{1}{2}$ is $1\frac{1}{4}$?
12. $7\frac{1}{2}$ yds. is 6 yds.?
13. What decimal of a century is 45 years? 63 years? $33\frac{1}{3}$ years? $8\frac{1}{2}$ years?
14. What decimal of a minute is $1\frac{1}{2}$ seconds?
15. Express $2\frac{3}{4}$ pecks as the decimal of 5 bushels.
16. Reduce 6 hrs. 22 min. 30 sec. to the decimal of a day.
17. Reduce 8 cwt. 34 lbs. to the decimal of a ton.
18. Express 40 sq. yds. as the decimal of an acre.
19. Reduce 213 rods to the decimal of a mile.
20. What decimal of 4s. 2d. is 2s. $7\frac{1}{2}$d.?

21. Reduce $2\frac{3}{8}$ miles to the decimal of 22 miles.

22. Reduce 1 qt. 1 pt. to the decimal of 1 bu. 1 pk. 1 gal.

23. Reduce 1 ac. 141 sq. rods to the decimal of 5 ac. 50 sq. rods.

IV.

Find the value of :—

1. $\frac{6}{13}$ of a foot.
2. $\frac{5}{24}$ of a yard.
3. $\frac{9}{10}$ of an acre.
4. $\frac{19}{20}$ of 5 dys. 14 hrs. 38 min.
5. $\frac{11}{12}$ of £5.
6. $\frac{13}{24}$ of 17 cubic feet.
7. 4·3665 weeks.
8. 12·4235 acres.
9. 590·357 pecks.
10. 2·725 miles.
11. ·4375 of a shilling.
12. 1·085 of 36 gallons.
13. ·09375 of an acre.
14. ·02755 of 5 days.
15. ·625 of 3 yds. 2 ft. 6 in.
16. 4·045 of 1 cwt. 82 lbs.
17. 3·125 of 10 yds. 2 ft.
18. ·695 of $1\frac{7}{8}$ miles.
19. $\frac{4}{5}$ of £3. 9s. 2d. − ·65 of £2. 8s. 4d.
20. ·705 ton + 3·375 cwt. + 2·8 lbs.
21. $\frac{3}{4}$ gal. + $\frac{1}{4}$ qt. + $1\frac{1}{2}$ pts.
22. $\frac{5}{7}$ week + $\frac{2}{5}$ day + $1\frac{5}{7}$ hours.
23. 3·42 mi. − 125·6 rods − 12·5 rods.

V.

Find by practice the value of:—

1. 508 articles at 50¢.
2. 305 " at 25¢.
3. 576 " at \$1.33⅓.
4. 704 " at \$3.20.
5. 198 " at \$4.16⅔.
6. 648 " at \$1.12½.
7. 211 " at \$2.10.
8. 300 articles at 8⅓¢.
9. 440 " at \$1.06¼
10. 506 " at \$2.37½
11. 409 " at \$3.75.
12. 316 " at \$4.40.
13. 127 " at \$1.87½.
14. 209 " at \$10.05.
15. 17 chests of tea, each 59 lbs., at 33⅓¢ a lb.
16. 158 tons of coal at \$5.33⅓ a ton.
17. 170 lbs. soap at 8⅓¢ a lb.
18. 295 lbs. 8 oz. butter at 33⅓¢ a lb.
19. 1260 pine apples at 16⅔¢ each.
20. 503 acres of land at 87½¢ a sq. rod.
21. 263 acres of land at \$1.37½ a sq. rod.
22. 5460 lbs. of hay at \$8.50 a ton.
23. 26 sacks of wool, each 560 lbs., at \$26.50 a ton.
24. 82 bushels 3 pecks of barley at \$0.60 a bushel.
25. 5 miles 550 yds. of railway at \$1600 the mile.
26. 25 days 7 hours work at \$2.40 a day (10 hrs.).
27. 71 pecks 5 quarts of cherries at \$0.40 a peck.
28. 11 tons 760 lbs. of coal at \$6 a ton.
29. 15 yds. 1 ft. 6 in. of gold wire at \$1.50 a yard.
30. 70 acres 2200 sq. yds. of land at \$55 an acre.
31. 20 cubic feet of mahogany at \$90 a cubic yard.
32. 2800 lbs. of scrap iron at \$15 a ton.
33. 15 quires 10 sheets of paper at \$2.40 a ream.
34. 33 lbs. 11 oz. of tea at \$0.80 a lb.
35. 1 yard 8 inches of sable at \$9 the yard.
36. 1 mile 1100 yards of barbed wire at \$30 the mile.

37. 5 yds. 1 ft. 9 in. at $1.62 per yard.
38. 17 acres 2057 sq. yds. of land at $18.72 the acre.
39. 18 yrs. 5 mos. 1 wk. salary at $1000 per year.
40. Salary for a year at £1. 1s. 11¼d. per day.
41. Rent of 29 houses at £13. 14s. 2d. each.
42. 1309 roubles at 2s. 5¼d. each.
43. 706,500 fire bricks at £3. 13s. 6d. per thousand.
44. 90½ dozen pairs of boots at 12s. 9d. a pair.
45. 107 shares at £93. 15s. 8d. each.
46. 27 yds. 1 ft. 5 in. at $0.45 per yard.
47. 15 acres 2662 sq. yds. at $1.10 per acre.
48. 154 bu. 3 pks. at $1.06⅔ the bushel.
49. 24 yrs. 5 mos. 3 weeks at $150 per annum.
50. 25 tons 155 lbs. at $16.80 the ton.

VI.

Find the value by cancelling of:—

1. $\frac{3 \times 15 \times 4}{20 \times 12 \times 9}$
2. $\frac{7 \times 25 \times 16}{8 \times 30 \times 14}$
3. $\frac{8 \times 14 \times 24}{32 \times 12 \times 7}$
4. $\frac{28 \times 5 \times 12}{20 \times 7 \times 32}$
5. $\frac{2 \times 5 \times 7}{10 \times 11 \times 11}$
6. $\frac{5 \times 21 \times 32}{48 \times 35 \times 3}$
7. $\frac{2 \times 50 \times 11}{33 \times 4 \times 10}$
8. $\frac{56 \times 42 \times 9}{7 \times 8 \times 27}$
9. $\frac{30 \times 6 \times 16}{3 \times 8 \times 40}$
10. $\frac{17 \times 85 \times 4}{20 \times 3 \times 3}$
11. $\frac{5 \times 81 \times 77}{11 \times 55 \times 63}$
12. $\frac{90 \times 40 \times 42}{100 \times 63 \times 24}$
13. $\frac{5{\cdot}5 \times {\cdot}081 \times 4{\cdot}9}{{\cdot}63 \times 4{\cdot}2 \times {\cdot}33}$
14. $\frac{2{\cdot}1 \times {\cdot}3 \ldots 12{\cdot}6}{5{\cdot}1 \times {\cdot}56 \times 4{\cdot}5}$
15. $\frac{4{\cdot}2 \times 14{\cdot}3 \times {\cdot}66}{3{\cdot}9 \times {\cdot}014 \times 1{\cdot}21}$

VII.

PROPORTION.

1. If 12 yds. of cloth cost \$15, what will 8 yds. cost?

2. If 57 cwt. of sugar cost \$216, what will 95 cwt. cost?

3. If the yearly rent of a farm of 182 acres be \$273, what is the rent of a part of it containing 42 acres?

4. If 385 yards of linen cost \$63, how many yards can be bought for \$18?

5. If 96 men reap 40 acres of grain in a week, how many men will reap 65 acres in the same time?

6. How many men would perform in 168 days a piece of work which 108 men can perform in 266 days?

7. If 84 sheep can be grazed in a field for 12 days, how long might 112 sheep be grazed in the same field?

8. A garrison of 2100 men, supplied with provisions for 9 weeks, receives a reinforcement of 600 men; how long will the provisions last?

9. When the price of a dozen books is \$14.75, what will a score cost?

10. A farmer has 12 men who can mow his hay in 10 days, but he wishes the work done in 8 days; how many additional men must he employ?

11. What will 10 boxes of oranges cost, if $3\frac{1}{3}$ boxes cost $\$5\frac{1}{4}$?

12. If I walk $2\frac{1}{2}$ miles in $\frac{3}{4}$ of an hour, how far can I walk in $5\frac{1}{4}$ hours?

13. If $1\frac{3}{4}$ bushels of potatoes last a family 2 weeks, how long will $5\frac{1}{2}$ bushels last?

14. If $3\frac{1}{2}$ barrels of apples cost \$14, how many barrels can be bought for \$20?

15. $\frac{1}{5}$ of a race is 500 yards, how long will $\frac{7}{25}$ be?

16. $\frac{8}{27}$ of a city contains 9000 inhabitants; what will $\frac{8}{81}$ of it contain?

17. If $7\frac{1}{2}$ acres be ploughed in $6\frac{1}{4}$ hours, how long will it take to plough $3\frac{5}{9}$ acres?

18. In how many hours can a field of $3\frac{1}{2}$ acres be reaped, if one of $5\frac{1}{4}$ acres is reaped in 6 hours?

19. If 100 dinners can be paid for with £$3\frac{1}{3}$, how many can be paid for with £$7\frac{1}{6}$?

20. If a certain quantity of corn feeds 12 horses for $11\frac{1}{4}$ days, how long will it feed 45 horses?

21. How many men can perform in 1·68 days a piece of work which 120 men perform in 2·66 days?

22. If $1\frac{1}{5}$ yards cost $17\frac{1}{3}$ cents, what will $3\frac{15}{16}$ yards cost?

23. If $11\frac{1}{3}$ cwt. cost $\$5\frac{3}{5}$, what will $4\frac{1}{4}$ cwt. cost?

24. If 3·75 cwt. is carried for \$0·875, what weight should be carried for \$2·625?

25. If 2·875 cwt. cost \$16·1, how much can be bought for \$19·75?

26. What is the rent of 21 acres 140 sq. rods of land if the rent of 36 acres 120 sq. rods be \$42?

27. If a person walks 17 miles in 5 hours 12 min. 31 sec., how far can he walk in 3 hours 40 min. 36 sec.?

28. If the earth moves 69,000 miles in its orbit in an hour, through what space does it move in 16 min. 48 sec.?

29. If I lend a person \$100 for 12 weeks, how long ought he in return to lend me \$175?

30. If $\frac{2}{3}$ lb. cost $\$\frac{7}{8}$, what will $\frac{5}{6}$ of 14 lbs. cost?

31. If a field of 16 acres produces 440 bushels of wheat, how much will be grown on 22 sq. yards?

32. The shadow of a man whose height is 5 ft. 3 in. was 4 ft. 6 in. at the same time that the shadow of a steeple was 156 ft. Find the height of the steeple.

33. How long would an iceberg be floating a distance of 1000 miles at the rate of 13 miles in 4 hours?

34. A certain room is 30 feet long and 18 feet broad; what is the length of another room of the same area, the breadth being 20 feet?

35. What will $33\frac{1}{2}$ dozen of Apollinaris cost at the rate of \$49 for 32 dozen and 8 bottles?

36. If the price of $43\frac{3}{7}$ yards of linen were $\$6\frac{5}{16}$, what would $16\frac{1}{8}$ yards cost?

37. How many yards of carpet 1·75 feet wide would cover a floor 8 yards long and 14 feet broad?

38. A room is $31\frac{1}{3}$ feet long and $15\frac{3}{4}$ feet wide; what is the width of another room of the same size, the length being $35\frac{3}{8}$ feet?

39. If 5·875 yards cost \$6.75, what will 31·5625 yards cost?

40. A cook's wages are \$288.35 a year; at the end of 118 days what will be owing to her?

41. A watch gains 10 min. 11 sec. in 24 hours; what will it gain in 6 days 12 hours?

42. The New York express starting at 5.15 P.M. reaches a station $109\frac{1}{2}$ miles distant at 9 minutes to 8; at what rate per hour does it travel, 10 minutes being allowed for stoppages?

43. From $\frac{1}{2}$ of 5 cwt. 28 lbs. take $\frac{1}{3}$ of 4 cwt. 56 lbs., and find the cost of the remainder at \$0.96 for 1 cwt. 28 lbs.

44. How long will it take to excavate a cellar 18 ft. long, 12 ft. broad and 10 feet deep, at the rate of 3 cubic yards 5 ft. in 1 hour 26 min.?

45. A cubic foot of water weighs $62\frac{1}{2}$ lbs.; what weight would a vessel 6 in. long, wide and deep contain?

46. From 11·002 take 1·12, and find the value of the remainder at $\$0.33\frac{1}{3}$ for ·0045.

VIII.

METRIC SYSTEM.

Metric Weights and Measures are those whose units increase and decrease regularly by the **Decimal Scale.**

The **metre** is the **base,** and from it the metric system derives its name.

The metric system has three principal units: the *metre* for measurements of length, the *litre* for capacity, and the *gram* for weight.

The *higher denominations* are formed by prefixing to the name of the unit the Greek numerals: **Deca,** signifying 10; **Hecto,** 100; **Kilo,** 1000; **Myria,** 10,000.

The *lower denominations* are formed by prefixing to the name of the unit the Latin numerals: **Deci,** signifying $\frac{1}{10}$ or ·1; **Centi,** $\frac{1}{100}$ or ·01; **Milli,** $\frac{1}{1000}$ or ·001.

E.g., Kilometre = 1000 metres.
Centimetre = $\frac{1}{100}$ of a metre.

MONEY.

100 centimes = 1 franc (fr.)

LENGTH.

10 **millimetres*** (mm.)	=	1 **centimetre** (cm.)
10 centimetres	=	1 decimetre (dm.)
10 decimetres	=	1 **metre** (m.)
10 metres	=	1 decametre (Dm.)
10 decametres	=	1 hectometre (Hm.)
10 hectometres	=	1 **kilometre** (Km.)
10 kilometres	=	1 myriametre (Mm.)

* Only units printed in **black letter** are in common use.

SURFACE MEASURE.

100 square millimetres = 1 **square centimetre** (sq. cm.)
100 square centimetres = 1 square decimetre (sq. dm.)
100 square decimetres = 1 **square metre** (sq. m.)

LAND MEASURE.

100 centiares (ca.) = 1 **are** (a.)
100 ares = 1 **hectare** (Ha.)

A *centiare* is the same in size as a *sq. metre.*

SOLID MEASURE.

1000 cubic millimetres = 1 **cubic centimetre** (cu. cm.)
1000 cubic centimetres = 1 cubic decimetre (cu. dm.)
1000 cubic decimetres = 1 **cubic metre** (cu. m.)

In measuring wood the *cubic metre* is called a **Stere.**

CAPACITY.

10 millilitres (ml.) = 1 **centilitre** (cl.)
10 centilitres = 1 decilitre (dl.)
10 decilitres = 1 **litre** (l.)
10 litres = 1 decalitre (Dl.)
10 decalitres = 1 **hectolitre** (Hl.)

WEIGHT.

10 **milligrams** (mg.) = 1 centigram (cg.)
10 centigrams = 1 decigram (dg.)
10 decigrams = 1 **gram** (g.)
10 grams = 1 decagram (Dg.)
10 decagrams = 1 hectogram (Hg.)
10 hectograms = 1 **kilogram** (Kg.)

1000 *kilograms* make a **metric ton.**

EQUIVALENTS.

1 metre = 39·37 inches.
1 kilometre = ·6214 mile.
8 kilometres = 5 miles (nearly).
1 sq. metre = 1·196 sq. yds.
1 hectare = 2·471 acres.
1 litre = 1·76 pints.
1 hectolitre = 22·01 gal.
1 gram = 15·432 grains.
1 kilo = 2·2046 lbs.
1 metric ton = 1·1023 tons.

A (*Length*).

The **metre** is the *principal unit*, and is used, like the yard, for measuring lengths of materials, such as cloth, and for short distances. For long distances, as along roads and railways, the **kilometre**, like the *mile*, is used.

1 metre = 39·37 inches.
1 kilometre = 0·6214 mile.

1. How many metres in a decametre? Hectometre? Kilometre?

2. What part of a metre is a decimetre? Centimetre? Millimetre?

3. Read in terms of the metre (or kilometre) and one other denomination :—

17·5 m.	41·625 m.	9·327 Km.	·1 m.
32·2 m.	54·886 m.	6·43 Km.	·01 m.
64·25 m.	29·7 Km.	5·68 Km.	·001 m.
23·62 m.	99·9 Km.	0·563 Km.	·001 Km.

4. Express in terms of a metre :—

5 m. 3 dm.	24 m. 49 mm.	2·3090 Km.
17 m. 24 cm.	54·38 Km.	27·056 Km.

5. Change :—

5747·3 m. to Km.	9471263 cm. to Km.
58·5 m. to cm.	4·8735 Km. to m.
53·35 m. to mm.	372·7575 m. to cm.

6. What is the total length of 5 pieces of cloth measuring respectively 12·6 m., 9·75 m., 26·08 m., 3·56 m., 31·5 m.?

7. If the work done by two men measures 18 m. and one has done 8·75 m., how much has the other done?

8. How many Km. in 85·72 m. multiplied by 2036?

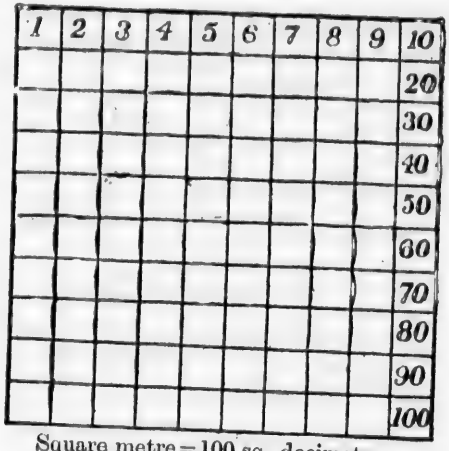
9. Cost of 37 m. of silk at 6·50 francs the metre?

10. A merchant made a profit of 12·60 francs by buying a piece of cloth at the rate of 7·50 francs for 5·30 m., and selling it at the rate of 24 francs for 15 m. How much did he buy?

11. It is 285 m. from home to school; how many Km. do I walk in 7 days, going to and fro once a day?

12. At 7·056 Km. an hour, how far shall I go in 6 hours 24 min.?

B (*Surface*).



Square metre = 100 sq. decimetres.

(The units of surface are obtained by squaring the units of length. Therefore 100 (10 × 10) units of a lower denomination make a unit of the next higher. Hence each denomination must occupy *two places* of figures, *e.g.*, 43·21 Ha. = 43 Ha. 21 a.)

The *square metre* is used in measuring ordinary surfaces, as floors, ceilings, etc. It is equal to about $10\frac{3}{4}$ sq. ft.

The *Are* and *Hectare* ($2\frac{1}{2}$ acres nearly) are used in measuring land.

1. How many sq. metres in a sq. Dm.? A sq. Hm.? A sq. Km.?

2. How many centiares in an are? In a hectare?

3. What part of a Ha. is an are? A centiare?

4. What part of a sq. m. is a sq. dm.? A sq. cm.?

5. How many sq. dm. in 5 sq. m.? 8 sq. m.? 15 sq. m.?

6. How many sq. cm. in 4 sq. m.? 7 sq. m.? 9 sq. m.?

7. How many sq. m. in 3·45 Ha.? 19·06 Ha.?

8. Add 7·9463 Ha., 68·45 a., 3·078 Ha., 73·56 a., 2·7608 Ha., 42·37 a.

9. How many sq. m. in a blackboard 2·5 m. long and 1·2 m. wide?

10. How many sq. m. in the floor of a room 9·75 m. long and 5·33⅓ m. wide?

11. How many Ha. in a field 220 m. square?

12. How many sq. m. of surface have the walls of a hall 14 m. long, 11·5 m. broad and 9·25 m. high?

13. How many panes of glass, each 1·25 m. by 1 m., would be required for 23 windows, each 5 m. by 4 m.?

14. Into how many fields, each containing 246·53 ares, could a farm of 41·9101 Ha. be divided?

15. Cost of 1·5340 Ha. of land at $2·385 an are?

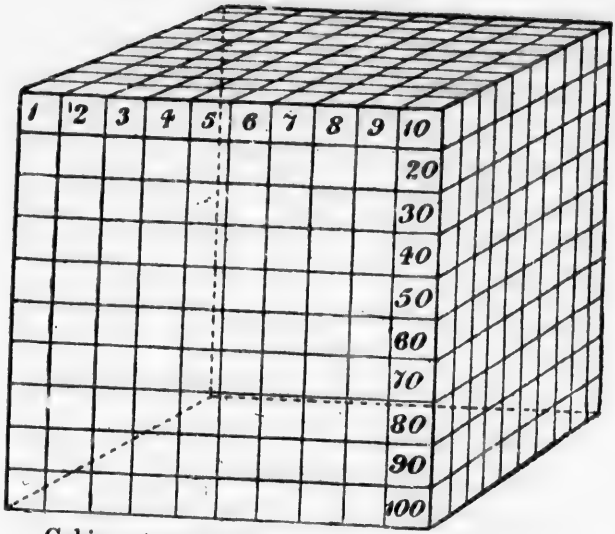
16. What is the length of a court whose breadth is 15·5 m. and area 2·945 sq. Dm.?

17. What is the area of the walls, floor and ceiling of a room which is 11 m. long, 8·25 m. wide and 5·75 m. high?

18. If 21·45 Ha. of land can be rented for 486·75 francs, what will be the rent of 28·60 Ha.?

19. Cost of covering the surface of a box 1·2 m. long, ·6 m. wide and ·25 m. high at ·006 fr. per sq. cm.?

C (*Solid Measure*).



Cubic metre = 1000 (10 × 10 × 10) cubic decimetres.

(The units of volume are cubes of the units of length, *i.e.*, 1000 (10 × 10 × 10) units of a lower denomination make a unit of the next higher. Each denomination will occupy *three* places of figures.)

1. In a cu. metre how many cu. dm.? Cu. cm.?

2. What part of a cu. metre is a cu. dm.? A cu. cm.?

3. Express in terms of a cu. m. 27 cu. dm.; 13 cu. m. 5 cu. cm.; 5 cu. dm. 37 cu. cm.; 15 cu. m. 101 cu. cm.

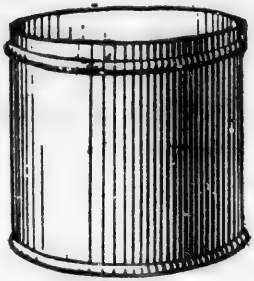
4. Read 4·406 cu. m.; ·004017 cu. m.; ·46 cu. m.

5. How many cu. m. of earth in a trench 47 m. long, ·47 m. wide and ·47 m. deep?

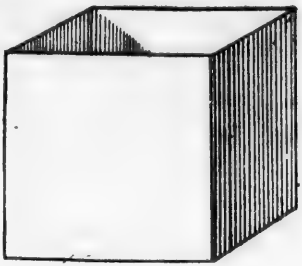
6. At $2.50 a stere, what is the cost of a pile of wood 3 m. long, 1·5 m. wide and 1·1 m. high?

7. How many cu. dm. of air in a room which measures 8·25 m. long, 5·64 m. wide and 3·65 m. high?

D (*Capacity*).



Litre.



Cubic decimetre.

The **Litre** is the principal measure, and holds about a quart. It has exactly the same capacity as a *cubic decimetre*.

The **Hectolitre** is equal to about 22 gal. or $2\frac{3}{4}$ bushels.

1. How many litres in a Hl.? A cu. dm.? A cu. m.?

2. How many cu. cm. in a litre? In a Hl.?

3. Read and express in terms of the litre 6·049 Kl.; 24·5705 cl.; 1567·009 Dl.; 63·0485 dl.

4. 364 dl. leaked out of a cask containing 73·0025 Hl. How much was left?

5. A gentleman buys 1·48 Hl. of wine at \$0.55 a litre, 72 l. at \$0.45 a litre, and 3 Hl. at \$1.05 a litre. Find the cost.

6. Find the value of 1180 Kl. 6 l. of barley at 20·05 francs a Hl.

7. Divide 203 l. of soup among 18 men and 22 women, giving each man double a woman's share.

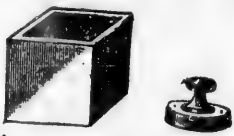
8. How long will 21579·2 l. last if 674·35 l. is consumed weekly?

9. A person allows 18·948 cu. m. of water to run from a tank containing 27,875 cu. dm. How many litres are left in the tank?

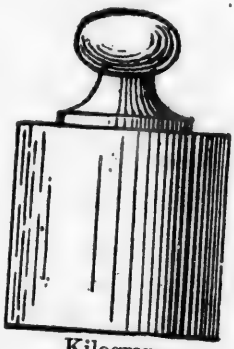
10. A wine merchant bought 875 Hl. of wine at 60 francs per Hl., and a certain number of Hl. of brandy at 175 francs per Hl. He paid 53,900 francs for the whole. How much brandy did he buy?

11. How deep is a tank to hold 9000 l. if the bottom is a square measuring 1·5 m. on a side?

E (*Weight*).



Cubic centimetre. Gram.



Kilogram.

A **cubic centimetre** of water weighs a **gram.**

A *gram* is used to weigh gold, silver and drugs.

A *kilogram* (called *kilo*) is used in weighing all common articles, as groceries, etc.

A *ton* is used in weighing coal, hay and heavy articles.

A kilo = 2·2 lbs. A metric ton = 1·1 tons Av.

1. How many grams in a kilo? In a Hg.?
2. What part of a ton is a kilo?
3. Weight of 1000 cu. cm. of water?
4. Weight of a cu. m. of water?
5. Weight of a litre of water?
6. If a cistern holds 6 cu. m. of water, what will be the weight of water when the cistern is full?
7. Change 25·426 kilos to grams; to tons.
8. Change to Kg. 553·273 g.; 48·63 g.; ·094 g.

9. A butcher buys one bullock weighing 382 kilos at 1·35 fr. a kilo, another bullock weighing 341 kilos at 1·25 fr. a kilo, a cow weighing 280 kilos at 0·95 fr. a kilo, and a calf weighing 59 kilos at 1·75 fr. a kilo. Find the total cost.

10. What quantity of tea at 8·75 fr. a kilo ought to be given in exchange for 700 kilos of sugar at 1·35 fr. a kilo?

11. At 1·5 cents a kilo, what will 3·25 tons of hay cost?

12. At $8 a ton, what will the coal cost to supply a factory for a week, if 250 kilos are burned each day?

13. If 7·25 kilos cost 399 francs, find the cost of 43·5 kilos.

14. How many loads of earth, each equal to a cubic metre, will it take to fill an excavation 4 Dm. long, 8 m. wide and 2·4 m. deep?

15. What is the value of a nugget of gold 2·6 cm. long, 2·3 cm. wide and 0·65 cm. thick at $15.40 a cu. cm.?

16. What is the length in metres of a gravel walk which is 2·4 m. wide and covers an area of 89·1 sq. m.?

17. What is the height in metres of a wall which is 180 m. long, ·625 m. thick and contains 562·5 cu. m.?

18. Make out the following bill:—

52·25 Hl. of wine at 2·45 francs a litre,
18 Hl. of wheat at 18·25 francs per Hl.,
·1 ton of sugar at 1·05 francs a kilo,
135·5 m. of plank at 1·20 francs a metre.
22·5 steres of wood at 17·50 francs a stere.

19. The wheel of a locomotive is $4\frac{1}{2}$ m. in circumference; owing to the state of the rails it loses 15 turns in every 100 revolutions. What distance is gone over in 56,100 turns of the wheel?

F

The following diagram, taken from Miller's "Inorganic Chemistry," shows the connection which exists between the various measures in the Metric System :—

Each side of this square measures

1 decimetre, or
10 centimetres, or
100 millimetres, or
3·937 inches.

1 sq. Centim.

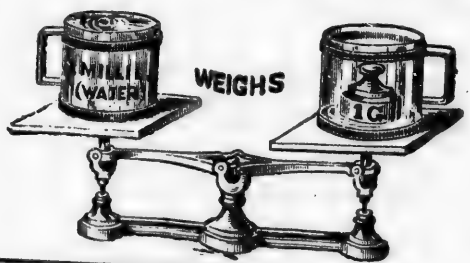
A *litre* is a cubic measure, each side of which has the dimensions of this figure.

A litre of pure water at 4° Centigrade weighs exactly 1 kilogram or 1000 grams.

A cubic centimetre of pure water at 4° C. weighs a gram.

1 cubic decimetre = 1 litre = 1 kilogram.

1 cubic centimetre = 1 millilitre = 1 gram.



4 inches.

The entire square is the 100th part of a square metre, and contains 15·5 square inches, or ·1076 of a square foot nearly.

1. How many litres in 6·5 cubic metres ?

2. Give the weight in kilograms of ·7456 cubic metres of water.

3. What is the weight of water required to fill a cistern 90 centimetres long, 64 centimetres wide and 36 centimetres deep?

4. A litre of a certain gas weighs 1·675 grams. How much does a cubic metre weigh?

5. How many litres in a vessel whose capacity is $4\frac{1}{2}$ cubic metres?

6. How many cubic metres in a rectangular tank 125 cm. long, 80 cm. wide and 60 cm. deep? How many litres? What weight of water would be required to fill it?

7. How deep must a cistern be to hold 8000 litres, if the bottom is a square 2·5 metres on a side?

8. Find the weight of a bar of iron 50 centimetres long, 4 centimetres wide and 1 centimetre thick, if iron weighs 7·8 times as much as water.

9. What is the weight in grams of $2\frac{1}{2}$ cubic metres of oil that weighs $\frac{9}{10}$ as much as water?

10. Find the weight in metric tons of the volume of water contained in a cistern 4·35 m. long, 3·64 m. wide and 2·85 m. deep, supposing the water to be at 4° Centigrade.

Change from the English to the metric system, or from the metric to the English system, using the equivalents given on p. 14:—

1. 35 yds. 2 ft. 9 in. to metres.
2. 3·75 metres to yds. ft. and inches.
3. 3 mi. 130 rods to Km. 4. 18·25 Km. to mi. and rods.
5. 6 lbs. 4 oz. to Kg. 6. 36,000 cg. to oz.
7. 356·121 kilograms to cwt. and lbs.
8. 4 sq. ft. 72 sq. in. to sq. m. 9. 45 sq. m. to sq. yds., etc.
10. 2 ac. 140 sq. rds. to Ha. 11. 3·5 Ha. to ac. and sq. rds.
12. 3 gal. 2 qts. 1 pt. to litres. 13. 36·7125 Hl. to gal.
14. 1800 gallons to cubic metres.
15. 47·875 cubic decimetres to gal. qts. pts.

IX.

MENSURATION.

1. What is the area of a square whose side is 9 ft. 6 in.?

2. A board is 16 in. long and 13 in. broad. Find its surface measure in sq. feet.

3. What will be the cost of tiling the floor of a hall 24 yds. long and 16 yards broad at $9 a square yard?

4. What will be the cost of flooring a room 18 ft. 3 in. long and 15 ft. 6 in. broad at 20 cents a sq. foot?

5. What will be the cost of whitewashing a wall 18 ft. 6 in. long and 10 ft. 9 in. high at $4\frac{1}{2}$ cents a sq. yd.?

6. How many yards of paper 20 inches broad will it take to cover a wall 16 ft. 4 in. by 10 ft.?

7. Cost of carpeting a room 18 ft. sq. with carpet 27 inches wide at $\$1.87\frac{1}{2}$ per yard?

8. How many yards of carpet 27 inches wide will cover a floor 22 ft. 8 in. long and 16 ft. 8 in. broad?

9. Cost of papering a room $26\frac{1}{2}$ ft. by $21\frac{1}{2}$ ft., 13 feet high, with paper 24 inches wide at 5 cents per yard?

10. How many bricks, each 9 in. long and $4\frac{1}{2}$ in. broad, will cover the floor of a kitchen 13 ft. 6 in. by 12 ft.?

11. The cost of the bricks, each 9 in. by $4\frac{1}{2}$ in., at 4 cents each, for covering a floor 15 feet wide, is $14.40. Find the length of the floor.

12. How many tiles, each 9 inches square, will cover the floor of a hall 20 ft. 3 in. by 8 ft.?

13. The cost of the tiles, each 4 in. by 6 in., at 3 cents each, for a hall 20 ft. long, is $19.20. Find the width of the hall.

14. A rug 18 ft. by 12 ft. 6 in. is laid down in a hall 20 ft. by 13 ft. 9 in. Find the cost of staining the border of the hall at 27 cents a sq. yard.

15. If the length of a rectangular field is 15 rods, what must be its breadth so that it may contain exactly an acre?

16. How many acres of ground are occupied by 100 miles of a road, 63 feet wide?

17. How many yards of fencing will be required to go round a field 40 rods long, which contains 5 acres?

18. How many inch cubes can be cut out of a cu. yd.?

19. What is the solid content of a block of stone 3 yds. 2 ft. long, 2 yds. 2 ft. broad and 1 yd. 2 ft. thick?

20. How many cubic ft. of water will a cistern contain which is 7 ft. 6 in. long, 4 ft. 6 in. broad and 4 ft. deep?

21. How many gallons of water will the cistern hold if a gallon contains 231 cubic inches?

22. The content of a cube whose side is 2 ft. 3 in.?

23. What will be the weight of a brick wall 10 ft. long, 4 ft. 2 in. high and 18 in. thick, if each cu. foot weighs 120 lbs.?

24. How many cu. yards of earth will be cut out of a drain 420 ft. long, 2 ft. broad and 4 ft. deep? In what time will a man complete the excavation, allowing that he can lift 500 cu. ft. of earth per day?

25. A canal is 300 yds. long, its breadth is 5 yds. 1 ft. and its average depth is 5 feet. What weight of water does it contain, a cubic foot of water weighing $62\frac{1}{2}$ lbs.?

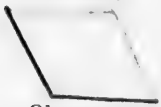
26. A cubic foot of water weighs 1000 ounces. What weight of water can be contained in a vessel, the length, width and depth of which are each a yard?

27. How many bushels can be put into a bin 6 ft. by 5 ft. by 4 ft., if a bushel measures 2150·4 cu. inches?

X.

ANGLES.

Right angle.



Obtuse angle.

Acute angle.

An **angle** is the opening between two straight lines meeting at the same point.

The *size* or *magnitude* of an angle depends entirely upon the *extent of opening*, and not upon the *length of the lines*. If the two lines forming the angle be prolonged, their extent of opening will not be changed, and the size of the angle will not be changed; but if one of the lines is movable and the other fixed, the size of the angle or opening will increase or decrease according as the movable line is drawn from or towards the fixed line.

(1) The opening formed when a vertical line meets a horizontal line is called a *right angle*.

(2) An **obtuse angle** is greater than a right angle.

(3) An **acute angle** is less than a right angle.

When one line meets another line so as to form a square opening or right angle, the one line is said to be **perpendicular** to the other.

AREA OF PARALLELOGRAMS.

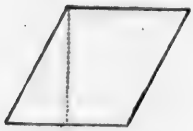
A **parallelogram** is a four-sided figure having its opposite sides equal and parallel.

Parallel lines are equally distant from each other at every point. If produced, they will never meet.

(The rails of a railroad run parallel to each other.)

A *square*, a *rectangle*, a *rhombus* and a *rhomboid* are parallelograms.

(For area of square and rectangle see Book II., p. 79.)



Rhombus.

Rhomboid.

A rhombus is a four-sided figure having all its sides equal, but its angles are not right angles.

A rhomboid is a four-sided figure having its opposite sides equal, but its angles are not right angles.

1. In the above figures point out the obtuse angles and the acute angles. Point out two right angles formed in each by the dotted line. The dotted line is the *perpendicular height*, or *altitude*.

2. The above figures are parallelograms. Why? Cut from paper figures of the same shape. Draw the perpendicular height (dotted line) and cut through it. Adjust the piece cut off to the other end of the figure so as to form a rectangle.

3. This is now a rectangle. Why? Measure the length and breadth. Find the area. Observe that the breadth of the rectangle is the same as the perpendicular height of the parallelogram.

4. How, then, can we find the area of a parallelogram?

Ans. *Area = length × perpendicular height.*

5. Find the area of a rhombus 12 feet long and 6 ft. 6 in. in perpendicular height.

6. Express in acres the area of a rhomboid 605 yards long and 32 yards in perpendicular height.

7. Find the height of a parallelogram 3 sq. yds. 4 ft. 36 in. in area and 7 ft. 6 in. in length.

8. A diamond-shaped lawn 53 ft. 4 in. long and 28 ft. in perpendicular breadth is to be sodded. How many sods, each 16 in. square, will be required? (*Draw plan.*)

B

Area of Triangles.

Right-angled triangle.

Equilateral triangle.

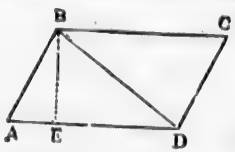
Isosceles triangle.

A **triangle** is a figure bounded by three straight lines.

A *right-angled triangle* has a right angle.

An *equilateral triangle* has three equal sides.

An *isosceles triangle* has two equal sides.



Line EB = perpendicular height.

Line BD = diagonal.

1. Cut from paper a parallelogram of the same shape as the above figure. Divide the parallelogram into two parts by cutting through the diagonal line BD. What kind of a figure is each part?

2. Compare the two triangles thus obtained. Are they equal to one another? What part of the parallelogram is each triangle?

3. What can you say of the size of a triangle and parallelogram having the same base and height?

4. Derive a rule to find the area of a triangle.

Ans. *Multiply the base by the perpendicular height and divide by 2.*

5. Draw and find the area of the following triangles:
Base, 8 ft.; perpendicular height, 4·47 ft. (Isosceles.)
Base, 12 ft.; perpendicular height, 10·4 ft. (Equilateral.)
Base, 9 ft. 2 in.; perpendicular height, 12 ft. 8 in

6. The base of a triangle is 13·24 chains and its height is 8·59 chains. Find the area in acres and rods, 10 sq. chains being equal to an acre.

7. Find the height of a triangle whose area is 27½ sq. yards and base 5 yards.

8. What is the base of a triangle whose area is 40 acres and perpendicular height 160 rods?

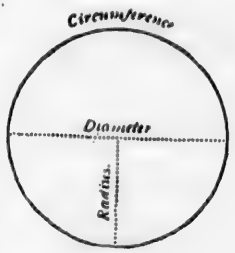
9. What will it cost to dig a triangular lot of ground whose base is 45 rods and height 20 rods, at 5 cents a sq. rod?

10. What will it cost to fence a piece of ground in the shape of an equilateral triangle whose sides are 8 rods each, at 12½ cents a foot?

C

Area of a Circle.

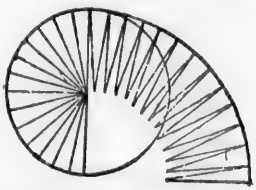
A **circle** is a plane figure bounded by a curved line, called the **circumference**, every part of which is equally distant from a point within, called the **centre**.



Circle.

The **diameter** is a straight line drawn through the centre and terminating at each end in the circumference.

The **radius** is a straight line drawn from the centre to the circumference, and is equal to half the diameter.



1. This circle has been divided into a number of triangles. If the number of triangles should be indefinitely increased, what can you say about the *relative length* of the side and perpendicular height of each triangle?

2. What will constitute the sum of the bases of the triangles?

3. How, then, find the area of a circle?

Ans. *Multiply the circumference by the radius and divide by 2.*

4. Measure the circumference and diameter of any circle and divide one by the other. How many times the diameter do you find the circumference?

5. How find the circumference of a circle?

Ans. *Multiply the diameter by* $3\frac{1}{7}$ *or by* 3·1416.

6. What is the circumference of a circle whose diameter is 15 feet? 45 yards? 100 rods?

7. What is the circumference of a circle when the radius is equal to 2·5 miles? 75 yards?

8. What is the diameter of a circle whose circumference is $6\frac{1}{2}$ feet? 94·2477 rods?

9. What is the radius of a circle whose circumference is 628·318 yards? 40 miles?

10. Find the area of the following circles:—

(*a*) Diameter, 10 ft.; circumference, 31·416 ft.
(*b*) Diameter, 20 feet. (*c*) Diameter, 100 feet.
(*d*) Radius, 60 rods. (*e*) Radius, 7 ft. 6 in.

11. Find the area of a circular pond whose diameter is 31 yards.

12. Find in acres and rods the space covered by a circular plantation 56·5 rods in circumference.

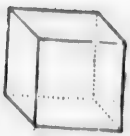
13. What is the surface measure of a round table whose diameter is 5 ft. 8 in.?

14. A horse is tied in a field by a cord $7\frac{1}{2}$ rods in length, one end of which is attached to a fixed stump. Find in acres and rods the area on which he can graze.

15. Find the girth of a round tree whose diameter is 13 inches.

D

SOLIDS.



Cube.

Triangular Prism.

Cylinder.

A **Cube** is a solid with six equal square faces.

A **Prism** is a solid that has two equal and parallel plane figures for its ends. Its sides are parallelograms. It is called *a triangular prism, a square prism, a pentagonal prism*, etc., according as it has *triangles, squares, pentagons*, etc., for it ends or bases.

A **Cylinder** is a round solid having circular ends.

1. How do you find the solid content of a cube? (Book II., p. 86.)

2. How do you find the solid content of a prism or cylinder?

Ans. *Multiply the area of the base by the height.*

3. Are these two rules really the same?

4. Make from paper* a triangular prism and spread it out flat. Its three upright faces become a figure of what kind? Its two ends are figures of what kind? How find the area of its three upright faces? Of its two bases? Of the whole?

5. Repeat the above process with a cylinder.

6. Give a rule for finding the area of a cube, prism or cylinder.

Ans. *Multiply the perimeter of the figure by its height. To this product* (*which is the area of the upright surface*) *add the area of the two bases.*

* This may be done by wrapping paper round a wooden model.

7. Find solid content and total area of:—

(*a*) A cube whose side is 6 feet.

(*b*) A square prism whose base is $2\frac{1}{2}$ yards by $2\frac{1}{2}$ yards, and height 4 yards.

(*c*) A triangular prism whose height is 20 feet, and whose base is an equilateral triangle with sides 12 feet in length and perpendicular height 10·4 feet.

(*d*) A cylinder whose height is 15 feet and the diameter of its base 3 feet.

8. What is the upright surface of a cylinder whose diameter is 20 feet and height 65 feet?

9. Find the cubic content of a log of wood whose height is 6 ft. 6 in. and its diameter 3 feet.

10. A cylinder is 3 feet long and $1\frac{1}{2}$ feet in diameter. How many square feet of canvas will be required to cover its upright surface? Its entire surface?

11. How many cubic feet in a triangular prism the area of whose base is 920 sq. ft. and height 20 feet?

12. Find the cubic content of a prism whose height is 25 inches and base a rectangle 3 by 5 inches.

13. Find the upright area of a triangular prism 5 feet high, whose base is an equilateral triangle with sides each 30 inches in length.

14. Express in cubic yards, feet and inches the content of a cube whose edge is 100 inches.

15. Express in square yards, feet and inches the surface of the above cube.

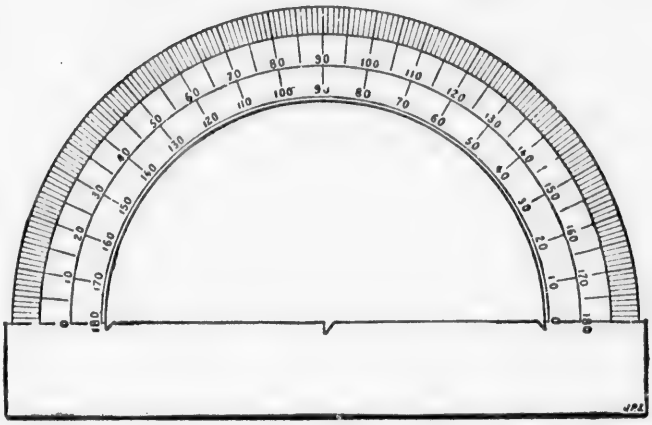
16. How many cubic feet of stone in a rectangular block 18 inches square at the end and 3 ft. 8 in. long?

17. A round tank is 16 feet deep and 8 feet in diameter. How much will it cost to cement the sides and bottom of it at 25¢ a square foot?

18. How many cubic feet of water will the tank hold?

XI.

CIRCULAR MEASURE.



60 seconds (″)	=	1 minute (′).
60 minutes	=	1 degree (°).
360 degrees	=	1 circumference.

For purposes of measurement the circumference of a circle is divided into 360 equal parts called degrees.

1. How many degrees in half a circumference?

2. How many degrees in a quadrant ($\frac{1}{4}$ circle)?

3. How many degrees in $\frac{1}{6}$ of the circumference? $\frac{1}{8}$ of the cir.? $\frac{1}{9}$ of the cir.? $\frac{1}{10}$ of the cir.?

4. Through how many degrees does the hour-hand of a clock move in 12 hrs.? In 6 hrs.? In 3 hrs.? In 1 hr.?

5. Through how many degrees does the minute-hand of a clock move in 1 hr.? In $\frac{1}{2}$ hr.? In 10 min.? In 1 min.?

6. In making a journey round the world through how many degrees would you pass?

A

1. Reduce 51° 23′ 41″ to seconds.
2. In 20,836″ how many degrees?
3. Find $\frac{2}{7}$ of the circumference of a circle.
4. Multiply 67° 23′ 17″ by 15.
5. Divide 84° 19′ 45″ by 15.
6. From 57° 4′ 29″ take 41° 17′ 54″.
7. What is latitude?
8. If one place is situated 59° north of the equator, and another 34° north, what is their difference in latitude?
9. If one place is situated 26° north of the equator, and another 11° south, what is their difference in latitude?
10. The latitude of Rome is 41° 53′ 54″ N., and that of Paris 48° 51′ 6″ N. Find their difference in latitude.
11. The latitude of London is 51° 30′ 49″ N., and that of New York is 40° 42′ 43″ N. Find their difference in latitude.
12. The latitude of North Cape is 71° 10′ N., and that of Cape of Good Hope is 33° 55′ 15″ S. Find their difference in latitude.

B

Longitude and Time.

1. What is a meridian?
2. What is the English standard meridian? How is it marked in degrees? **Ans.** Greenwich, 0°.
3. What is longitude? What is East longitude? West longitude? If two places are on opposite sides of the standard meridian, how is their difference in longitude found?
4. How many hours does the earth take to turn on its axis, or describe a circumference?

5. 24 hours in time = 360° longitude.
1 hour in time = 15° longitude.
1 minute in time = 15′ longitude.
1 second in time = 15″ longitude.

6. How express longitude in time?

Ans. *Divide the number of degrees, etc., by* 15.

7. How express time in longitude?

Ans. *Multiply the number of hours, etc., by* 15.

8. If the difference of time between two places is 19 min. 12 sec., what is their difference in longitude?

9. If the difference in longitude between two places is 20° 36′ 15″, find the difference in time.

10. The difference of time between Albany and San Francisco is 3 hrs. 14 min. $47\frac{2}{3}$ sec. Find their difference in longitude.

11. The difference in longitude between St. Petersburg and Washington is 107° 19′ 45″. Find their difference in time.

12. Montreal is 73° 25′ and St. Paul 93° 4′ west of Greenwich. What is the difference in clock-time between the two cities?

13. Montreal is 73° 25′ W. and Paris 2° 20′ E. of Greenwich. Find their difference in time.

14. How much earlier does the sun rise in Montreal than in New York, lon. 74°? In Chicago, lon. 87° 37′ 45″? In San Francisco, lon. 122° 26′?

15. When it is 9 A.M. in Montreal, what is the time in New York? In Chicago? In San Francisco?

(Time will be later in places *east*; earlier in places *west*. Why?)

16. When it is 3 o'clock in the afternoon at Greenwich, what will be the time in Montreal, lon. 73° 25′ W.? In Constantinople, lon. 29° E.? In Calcutta, 88° 27′ E.?

XII.

PERCENTAGE.

Per cent. means *in every hundred.*

The **sign** of **per cent.** is %. Thus, 5% means 5 per cent. or 5 in every hundred.

Percentage is the process of computing by the hundred.

The **base** is the number on which the percentage is computed.

The *number of hundredths* taken is called the **rate per cent.**

1. When a number is divided into 100 equal parts what is one of the parts called? Two of the parts? Five of the parts? Twenty of the parts?

2. A man had \$500 and lost \$10 out of every hundred; how many dollars did he lose? How many hundredths of his money did he lose? What per cent. did he lose?

3. How many hundredths of a number is 1%, 2%, 7%, 15%, 20%, $7\frac{1}{2}$%, $12\frac{1}{2}$%, $33\frac{1}{3}$%?

4. How many hundredths of 100 is 5? What per cent.?

5. What fraction of 100 is 5? What decimal?

6. Read and verify the following table:—

1%	=	·01	=	$\frac{1}{100}$	$33\frac{1}{3}$%	=	$\cdot 33\frac{1}{3}$	=	$\frac{1}{3}$
5%	=	·05	=	$\frac{1}{20}$	$66\frac{2}{3}$%	=	$\cdot 66\frac{2}{3}$	=	$\frac{2}{3}$
10%	=	·1	=	$\frac{1}{10}$	$12\frac{1}{2}$%	=	·125	=	$\frac{1}{8}$
20%	=	·2	=	$\frac{1}{5}$	$37\frac{1}{2}$%	=	·375	=	$\frac{3}{8}$
25%	=	·25	=	$\frac{1}{4}$	$62\frac{1}{2}$%	=	·625	=	$\frac{5}{8}$
50%	=	·5	=	$\frac{1}{2}$	$87\frac{1}{2}$%	=	·875	=	$\frac{7}{8}$
75%	=	·75	=	$\frac{3}{4}$	$6\frac{1}{4}$%	=	·0625	=	$\frac{1}{16}$
100%	=	1·0	=	$\frac{1}{1}$	$8\frac{1}{3}$%	=	$\cdot 08\frac{1}{3}$	=	$\frac{1}{12}$

A (*Sight*).

1. Read the following decimals as rates per cent.:—

·75 ·8 ·605 ·003 1·45 ·015 ·335
·06 ·6 ·08½ ·00¾ 1·3 2·25 2·445

2. Find the decimal and per cent. equivalent to:—

$\frac{1}{5}$ $\frac{1}{10}$ $\frac{1}{4}$ $\frac{1}{12}$ $\frac{1}{8}$ $\frac{1}{11}$ $\frac{1}{3}$ $\frac{2}{7}$ $\frac{7}{100}$ $1\frac{3}{8}$
$\frac{3}{4}$ $\frac{7}{8}$ $\frac{2}{3}$ $\frac{7}{20}$ $\frac{7}{50}$ $\frac{3}{5}$ $\frac{7}{25}$ $\frac{9}{10}$ $1\frac{1}{2}$ $2\frac{3}{10}$

3. Find the per cent. equivalent to 7 in every hundred; 1 in every hundred; 3 in 20; 5 in 8; 7 in 50; 75 in 1000; 225 men out of every thousand; 2 in a dozen; nine in a score; 12 in a gross.

4. Find the fractions (in lowest terms) and decimals equivalent to:—

50% 25% 5% 4% 33⅓% 12½% 8⅓%
45% 66⅔% 11⅑% 14⅐% 175% 325% 137½%

5. What per cent. is:—

13 cents of $1?	800 lbs. of a ton?	9 in. of a yd.?
3½ dys. of 1 wk.?	89 lbs. of 1 cwt.?	½ doz. of a score?
1 qt. of 1 pk.?	1d. of 1s.?	30 min. of 5 hrs.?
1 pt. of 1 qt.?	1 cwt. of 1 ton?	1 pt. of 1 gal.?

B (*Sight*).

1. ½ of 850	·5 of 86	50% of 124.
2. ⅓ of 396	·33⅓ of 240	33⅓% of 333.
3. $\frac{1}{10}$ of 550	·1 of 384	10% of 175.
4. ¾ of 30	·75 of 20	75% of 50.
5. 1¼ times 16	1·25 times $40	125% of 60.
6. 2½ times $1.20	2·5 times $6	250% of 100.
7. $\frac{1}{200}$ of 1000	·005 of 400	½% of 600.
8. $\frac{1}{500}$ of 2000	·002 of 500	⅕% of 200.
9. $\frac{1}{16}$ of $4.80	·0625 of 32	6¼% of 80.
10. ⅜ of 40	·375 of 64	37½% of 100.

C

Percentage = *Base* × *Rate.*

1. 35% of 846.
2. 92% of 1004.
3. 16% of $4.35.
4. $6\frac{1}{4}$% of $1000.
5. $37\frac{1}{2}$% of $1568.
6. $42\frac{1}{2}$% of $4820.
7. 9% of $3465.
8. 10% of $250.
9. 8% of $600.
10. 25% of $120.
11. $6\frac{1}{4}$% of $320.
12. 20% of $250.
13. 100% of $350.
14. 6% of 400 men.
15. 7% of 300 acres.
16. 20% of 275 gal.
17. 8% of 50 days.
18. 13% of 300 sheep.
19. 103% of $34.78.
20. 113% of 784·1 miles.
21. 4% of 8·845.
22. $8\frac{2}{3}$% of $748.02.
23. 1·1% of $1477.75.
24. $\frac{7}{8}$% of 2490
25. 8% of ·0004.
26. 75% of 244 tons.
27. 60% of 350 marbles.
28. $33\frac{1}{3}$% of 393 eggs.
29. $16\frac{2}{3}$% of 624 soldiers.
30. $8\frac{1}{3}$% of 672 yards.
31. $12\frac{1}{2}$% of 848 boys.
32. $37\frac{1}{2}$% of 960 rods.
33. $87\frac{1}{2}$% of 800 bricks.
34. $\frac{1}{3}$% of 600 oranges.
35. $\frac{4}{5}$% of 500 bushels.
36. 120% of 60 lbs.

D (*Questions 1–10 at sight*).

1. In a school of 700 children 10% are absent. How many are absent?

2. A teacher receiving $50 a month has her salary increased 20%. What was the increase per month?

3. A house and lot cost $4000. The lot cost $37\frac{1}{2}$% of the whole. What was the cost of the lot?

4. In a school of 600 pupils $66\frac{2}{3}$% are girls; how many are girls? How many boys? What per cent. are boys?

5. My income is $720, I lose $12\frac{1}{2}$%. What is my loss?

6. Of a regiment of 960 men $6\frac{1}{4}$% are killed; how many survive?

7. I had \$750 in the bank and drew out 4% of it. How much was left?

8. A town of 10,000 inhabitants increased 25% in 5 years. Find its population.

9. In a school of 300 pupils 7% study Latin, 15% Algebra, $66\frac{2}{3}$% French and 75% Arithmetic. How many pupils study each of these subjects?

10. I have 40 cent-pieces, 20% more quarters than cents, and $81\frac{1}{3}$% more dollars than quarters; how many dollars have I?

---

11. I had \$875 in the bank and drew out 15 per cent. of it; what remains?

12. In a village containing 330 people $13\frac{7}{11}$ per cent. are under 10 years of age. How many are under 10? What percentage are 10 or over?

13. Which is greater, 7% of \$6300 or 6% of \$7200?

14. A farmer raised 5972 bu. of grain and sold 65 per cent. of it at \$0.65 per bushel. How much did he receive?

15. I spend $18\frac{3}{4}$ per cent. of \$950. How much have I left?

16. If I buy a cow for \$64.50, at what must I sell it to gain 10 per cent?

17. The prime cost of some goods is \$3.75; for what must they be sold so as to gain $15\frac{1}{2}$ per cent.?

18. I buy a farm for \$2225; for what do I sell it if I lose 8 per cent.?

19. What is 11 per cent. of £10.?

20. What is 55 per cent of 12 cwt. 90 lbs.?

21. The population of a city in 1880 was 100,384. During the following ten years it had gained 113 per cent. Find its population in 1890.

XIII.

A (*Sight*).

1. What fraction of

4 is 2?	80 is 15?	100 is 3?
12 is 6?	75 is 50?	100 is 25?
20 is 5?	60 is 40?	100 is 89?

2. What per cent. of a number is the whole of it? $\frac{1}{2}$ of it? $\frac{1}{3}$ of it? $\frac{1}{4}$ of it? $\frac{1}{5}$ of it? $\frac{1}{6}$ of it? $\frac{1}{8}$? $\frac{2}{3}$? $\frac{3}{4}$? $\frac{2}{5}$? $\frac{3}{5}$? $\frac{3}{8}$? $\frac{1}{50}$? $\frac{1}{100}$?

3. (*a*) What fraction, (*b*) what decimal, (*c*) what per cent. of

25 is 5?	20 is 12?	2 is $\frac{1}{2}$?
15 is 6?	25 is 12?	2 is $\frac{1}{4}$?
10 is 3?	25 is 7?	3 is $\frac{2}{3}$?
25 is 15?	200 is 50?	$\frac{4}{5}$ is $\frac{8}{9}$?

B (*Sight*).

What per cent. of

1. 100 is $12\frac{1}{2}$?
2. $16\frac{2}{3}$ is 6?
3. $33\frac{1}{3}$ is 10?
4. \$300 is \$12?
5. \$450 is \$90?
6. 1s. is $4\frac{1}{2}$d.?
7. 66 days is 11 days?
8. 66 men is 6 men?
9. 2 days is 8 hours?
10. \$1 is $6\frac{1}{4}$ cents?

11. I had 400 sheep and sold 120. What per cent. did I sell?

12. I had 400 sheep; I now have 500. What is the per cent. of increase?

13. I had 400 sheep; I now have only 260. What per cent. of decrease? What per cent. have I left?

14. Paid \$25 for a chest of tea and sold it for \$6 more than I gave; what per cent. of profit?

15. Bought a horse for $25 and sold him for $50; what per cent. was the profit?

16. I lose $\frac{7}{8}$ of my money. What per cent. still remains to me?

17. If a pint of water is added to a gallon of milk, what per cent. of it is water?

18. I lost $16\frac{2}{3}\%$ of my money; what per cent. had I left?

19. 40 marbles; gave away 15; what per cent. did I give away? What per cent. did I keep?

20. 6 oranges in a box containing 5 dozen are bad; what per cent. are good?

Rate = Percentage ÷ Base.

1. What per cent. of
   - $7\frac{1}{3}$ is $2\frac{3}{4}$?
   - $\$5\frac{1}{4}$ is $\$4\frac{2}{3}$?
   - $420 is $60?
   - $1600 is $96?

2. What per cent. of
   - 63 miles is 10·08 miles?
   - 154 lbs. is 7 lbs. 11·2 oz.?
   - 4 yds. is 9 inches? $6\frac{1}{4}$
   - 142 yds. 8 in. is 32 yds.? $22\frac{1}{2}$

3. If 24 apples are spoiled in a barrel containing 288, what per cent. is spoiled? $8\frac{1}{3}$

4. In a school of 180 pupils 153 pass an examination; what per cent. fails?

5. If the rent of a house is reduced from $375 to $350, how much is the reduction per cent.?

6. If the rent is increased from $425 to $459, how much is the increase per cent.? 8

7. How much per cent. is 1s. 6d. in the £1.? $7\frac{1}{2}$

8. I pay $1 for a book of which the published price is $1.20; what per cent. is the reduction? $16\frac{2}{3}$

9. From a cask containing 90 gal., 4 gal. 2 qts. leaked out; what per cent. leaked out?

10. In a village containing 2088 people 87 die of fever; what is the death rate per cent.?

11. To 72 gallons of milk 3 gallons of water are added; what per cent. of the mixture is water?

12. An article bought for \$2.50 is sold for \$2.75; what is the gain per cent.?

13. If I gain $1\frac{1}{2}$ cents on every 12 cents, what do I gain on the dollar?

14. Bought eggs at 16 for a quarter and sold them at 13 for a quarter; what is my gain per cent.?

15. A fruit-dealer bought oranges at 25 cents a score, and sold them at 25 cents a dozen; what did he gain p.c.?

16. If I buy at 30 a dollar and sell at \$0.75 a dozen, what is my gain per cent.?

17. In dictation I spell 235 words correctly out of 250; what per cent. of the words are correct?

18. What per cent. of 75 bu. 3 pk. are 50 bu. 2 pk.?

19. Sugar which cost \$4.37$\frac{1}{2}$ a cwt. is sold at the rate of 20 lbs. for a dollar; what is the gain per cent.?

20. If the population of a town increases from 8624 to 9702, what is the increase per cent.?

XIV.

A (*Sight*).

1. 8 is $\frac{1}{3}$ of what number? $\frac{2}{3}$? $\frac{1}{6}$? $\frac{1}{7}$? $\frac{4}{7}$?

2. 24 is $\frac{2}{3}$ of what number? $\frac{3}{4}$? $\frac{4}{5}$? $\frac{4}{9}$? $\frac{6}{11}$? $\frac{1}{8}$? $\frac{1}{50}$? $\frac{3}{50}$? $\frac{1}{100}$? $\frac{6}{100}$? $\frac{50}{100}$?

3. 12 is 50% of what number? 10%? 20%? 25%? 30%? 40%? 60%? 70%? 75%? 80%? 100%?

4. 16 is 1% of what number? $\frac{1}{2}$%? $\frac{1}{4}$%? $\frac{1}{8}$%? 8%? $\frac{3}{4}$%? 75%? 200%? $8\frac{1}{3}$%?

Find the number of which

5. 48 is 6%
6. 24 is 4%
7. 32 is 5%
8. 48 is 20%
9. $12\frac{1}{2}$ is 10%
10. $6\frac{1}{4}$ is 25%
11. 5 is $8\frac{1}{3}$%
12. 50 is $62\frac{1}{2}$%
13. 60 is 60%
14. $\frac{1}{2}$ is $16\frac{2}{3}$%
15. $\frac{3}{4}$ is 50%
16. 20 is $\frac{1}{8}$%
17. \$40 is 20%
18. \$68 is 34%
19. 25 doz. is $12\frac{1}{2}$%
20. 15 is 125%
21. 750 mi. is 50%
22. 40 yds. is 5%
23. 75 is $166\frac{2}{3}$%
24. 15 days is 1%

B

Base = Percentage ÷ Rate.

1. 85 is $\frac{5}{8}$ of what number?
2. 225 is .625 of what number?
3. 555 is $62\frac{1}{2}$% of what number?
4. \$495 is $\frac{9}{8}$ of what sum? 180% of what sum?
5. \$9820 is 85 per cent. of what sum?
6. 219 tons is 60% of what quantity?
7. £2000 is 115 per cent. of what sum?
8. \$873.25 is $4\frac{1}{2}$ per cent. of what sum?
9. \$476 is $\frac{1}{8}$ per cent of what sum?
10. \$175,420 is $112\frac{1}{2}$% of what sum?

C (*Questions 1–5 at sight*).

1. A scholar has 18 examples in arithmetic correct, which is 75% of the whole; how many examples given?

2. In the ten years ending 1890 a city increases 8000 in population, a gain of 25 per cent. What was its population in 1880?

3. Butter is sold at 25 cents a lb., which is 200% of its cost. Find its cost.

4. I spend \$1200 or 80% of my salary; what is my salary?

5. I sell a horse for $90, which is 120% of its cost; what did it cost?

6. The number of children attending school is 862 or 20% of the population; what is the population?

7. A house was sold for $6300 or 250 per cent. of its cost; what did it cost?

8. 4% of 230 bu. is 5% of what quantity?

9. $12\frac{1}{2}$% of $530 is $6\frac{1}{4}$% of what sum?

10. Sold goods at a gain of 22%. The profit was $47.80. For how much were they sold?

XV.

A (*Sight*).

1. 10 is $\frac{1}{4}$ more than what number? 25 more? 25% more?

2. 10 is $\frac{1}{3}$ more than what number? $33\frac{1}{3}$% more?

3. 8 is $\frac{1}{3}$ less than what number? $\frac{2}{3}$ less?

4. 70 is $12\frac{1}{2}$% less than what number? 50% less?

5. 36 is $12\frac{1}{2}$% more than what number? 10% less?

6. What number increased by 25% of itself is 100?

7. What number increased by $6\frac{1}{4}$% is 68?

8. What number increased by 25% is 35?

9. What number diminished by 20% is 60? Is 48?

10. What number diminished by 30% is 70? Is 49?

11. A horse was sold for $40 which was $33\frac{1}{3}$% more than his cost; what was paid for him?

12. A jeweller sold a watch for $110, gaining 10%. What did it cost?

13. A pupil answered 24 questions correctly, which was 20% less than the total number. How many questions were asked?

14. A pig cost $21, which is $16\frac{2}{3}$% more than the price of a calf. Find the price of a calf.

B

What number increased — What number diminished

1. By 10% is $2750? 2500
2. By 16% is $2552? 2200
3. By 20% is $3720? 3100
4. By 28½% is $8995? 7000
5. By 3% is $98.80? 95.92
6. By 15% is 5100? 6000
7. By 7½% is 6475? 7000
8. By 12½% is 13125? 15000
9. By 6% is 2100?
10. By 12% is 1200?

11. My flock of sheep increased 8 per cent.; I had then 324. How many had I at first? 300 sheep

12. I lost 8 per cent. of my flock of sheep and had 276 remaining. How many had I at first? 300

13. A town after decreasing 11% has 4539 inhabitants. How many inhabitants had it at first? 5100

14. If after decreasing 22 per cent. the population is 3003, what was it before the decrease? 3850

15. What was the original price of a book sold for $1.20 at a loss of 36 per cent.? 1.87½

16. After increasing 11 per cent. the population is 5883; what would it be if it has decreased 11 per cent.? 4721

17. What percentage of a regiment survive, if ⅛ die in battle, ⅛ of their wounds, and ¼ of fever? 38⅓

18. A shepherd loses ¼ of his flock and then 20% of the remainder, and has 384 left. What was the original number? 640 sheep.

19. By selling 500 sheep for $2695 I gain 10 per cent.; what did each sheep cost? $4.90

20. I lose 20% of my money and then 12½% of the remainder, and have $2240 left; how much had I? 3200

21. Of the eggs sold by an old woman 3¾ per cent. are bad and 154 are good. How many were sold? 160 eggs

22. A grocer sold 950 barrels of flour for $5760, which was 20% advance on the cost; what was the entire cost, and the cost per barrel? $5.05 ÷ 19 = $4800 and 3

XVI.

PROFIT AND LOSS.

The difference between the buying and selling prices is called **Profit** or **Loss**, according as the selling price is more or less than the buying price.

Profit and loss are calculated by percentage.

The *cost* is the *base*.

A (*Sight*).

What is the selling price in the following cases:—

1. Cost price \$100, (*a*) 5% profit, (*b*) 10% loss?
2. Cost price \$500, (*a*) 10% profit, (*b*) 20% loss?
3. Cost price \$20, (*a*) 20% profit, (*b*) 30% loss?
4. Cost price \$120, (*a*) 40% profit, (*b*) 50% loss?

What is the profit or loss % in the following:—

5. Cost price \$200, (*a*) \$20 gain, (*b*) \$20 loss?
6. Cost price \$600, (*a*) \$30 gain, (*b*) \$100 loss?
7. Cost price \$40, (*a*) \$5 gain, (*b*) \$13⅓ loss?
8. Cost price \$500, (*a*) \$5 gain, (*b*) \$10 loss?
9. Goods sold at double the cost? 1¼ times the cost?

What was the cost price in the following:—

10. Selling price \$120, (*a*) 20% gain, (*b*) 20% loss?
11. Selling price \$150, (*a*) 25% gain, (*b*) 25% loss?
12. Selling price \$300, (*a*) 50% gain, (*b*) 50% loss?
13. Selling price \$140, (*a*) 40% gain, (*b*) 30% loss?
14. I buy a cow for \$25 and sell her for \$30. What have I gained per cent.?
15. Sugar costing \$150 is sold for \$165. Find the gain per cent.
16. If the gain on \$9 is \$2, what is the gain %?

17. Bought goods for $25; for how much must they be sold to gain 8 per cent.?

18. What must a table costing $57 be sold for so as to gain 5 per cent.?

19. What must be the selling price of goods which cost $32 to yield 25% profit?

20. If the gain on $24 be $3, what is that per cent.?

21. A person bought goods for $64 and sold them for $72; how much was gained per cent.?

22. A picture costing $75 was sold for $60. Find the loss per cent.

23. By selling goods for $5, 25% is gained on the cost price. Find the cost price.

24. Selling price $48, gain 20%. Find cost price.

25. Selling price $48, loss 20%. Find cost price.

26. Cost price $80, selling price $60. Find loss p.c.

27. Cost price $10, selling price $12. Find gain p.c.

B

1. Cost price $96.50, profit 6%. Find selling price.

2. Cost price $2750, loss 35%. Find selling price.

3. Selling price $675¼, profit 10½%. Find cost price.

4. Selling price $2750, loss 15%. Find cost price.

5. Cost price $3584, selling price $4175.36. Gain %?

6. Cost price $8500, selling price $6970. Find loss %.

7. If I lose 5 per cent. by selling a watch for $47.50, at what must I sell it to gain 8 per cent.?

8. If I lose 8 per cent. by selling a machine for $23, at what must I sell it to gain 15%.

9. If I gain 10 per cent. by selling for $45, how much per cent. should I lose by selling for $36?

10. If I gain 8 per cent. by selling for $63, at what must I have sold to lose 16%?

11. If I lose 10 per cent. by selling at $40, how much per cent. should I gain by selling at $52?

12. By charging $15.75 for an article 5% is gained; how much % would be gained by charging $16.50?

13. Selling cheese at 16½ cents I gain 10%; at what must I sell it to gain 20 per cent.?

14. By selling an estate for $15,000 a man gains 20 per cent.; how much did he give for it?

15. By selling an article at a profit of $2.50 I gain 16 per cent.; what did I give for it?

16. Sold goods at a loss of 20% and actual loss of $57.50. Find the prime cost.

17. What is received for 30 yards of cloth costing 55 cents a yard, when sold at an advance of 20%?

18. Bought apples at 3 for a cent.; how many can be sold for 5 cents to gain 6⅔ per cent.?

19. A merchant sells 95 bags of rice for $35⅝, thus gaining 12½ per cent.; find the prime cost per bag.

20. An agent sold a lot of ground 25 feet front by 75 feet deep, at 80 cents a square foot, and charged the owner 2% of the money received for his services. What was the agent's commission? What did the owner receive?

21. A commission merchant sold 150 barrels of flour at $5.80 a barrel and charged 4% commission. What was his commission?

22. A commission of 5% is charged by an agent for collecting an account of $49.80; what sum does he pay to his employer?

23. If $420 are paid annually for insuring a property for $18,000, what is the rate per cent.?

24. If $72 are paid for insuring $4800, what is the rate?

25. How much must be paid for insuring a store and goods valued at $7500, if the rate is 1½%?

XVII.

INTEREST.

Interest is money paid for the *use* of money lent.

Principal is the sum lent.

Rate of Interest is the *rate per cent.* of the principal payable *annually.*

Amount is the *sum* of the principal and interest.

A (*Sight*).

1. If the interest of 100 is \$6 for a year, what would be the interest of \$50 for the same time? Of 200? Of \$300? Of \$400? Of \$150? Of \$250?

2. If \$6 is paid for the use of \$100 for a year, how much should be paid for 6 months? 3 months? 4 months? 8 months? 9 months? 1 month? 11 months?

3. What part of a year is 6 mos.? 4 mos.? 3 mos.? 2 mos.? 8 mos.? 7 mos.? 9 mos.? 10 mos.? 11 mos.?

4. What part of 1 year's interest is the interest on the same sum for 1 mo.? 2 mos.? 3 mos.? etc.

5. Reckoning a month as 30 days, what part of a month is 15 days? 10 days? 6 days? 5 days? 2 days?

6. If the interest on a sum of money for a month is \$24, what is it for 15 days? 5 days? 3 days? 20 days?

7. What is the interest for 1 year at 5% on \$100? \$300? \$500? \$450? \$50? \$1200?

8. What is the interest for 2 years at 5% on the above sums?

9. Interest for 2 years 6 mos. at 4% on above sums?

10. Interest for 2 years at $3\frac{1}{2}$% on the above sums?

B

Interest = *Principal* × *Rate* × *Time.*

(Express **rate** *decimally, e.g.*, $6\% = \frac{6}{100} = .06$.)

Find the simple interest on :—

1. $627 at 5 per cent. for 2 years.
2. $203 at 6 per cent. for $3\frac{1}{3}$ years.
3. $910 at $5\frac{1}{5}$ per cent. for 3 years.
4. $825 at $3\frac{1}{5}$ per cent. for $3\frac{3}{4}$ years.
5. $775 at $2\frac{1}{4}$ per cent. for 4 months.
6. $64 at $4\frac{3}{8}$ per cent. for 15 months.
7. $607 at 4 per cent. for 7 years.
8. $144 at $1\frac{1}{5}$ per cent. for $1\frac{3}{8}$ years.
9. $510.62\frac{1}{2}$ at 4 per cent. for 4 years.
10. $400 at $3\frac{3}{8}$ per cent. for 6 years 11 months.
11. $750 at $19\frac{3}{5}$ per cent. for 4 years 3 months.
12. $1250 at $1\frac{3}{5}$ per cent. for 9 years 2 months.
13. $205.25 at 5·75 per cent. for 18·375 years.
14. $1900·875 at 4·45 per cent. for 6·125 years.
15. $280.14 at 3·86 per cent. for 5·19 years.
16. $150.50 at $3\frac{3}{4}$ per cent. for 3 years 3 months.
17. $125.62\frac{1}{2}$ at $7\frac{1}{2}$ per cent. for 9 years 10 months.
18. $3000 at $1\frac{9}{10}$ per cent. for 1 year 11 months.

Find the simple interest and amount of :—

19. $248.60 at 6 per cent. for 3 months.
20. $275 at 6 per cent. for 2 months.
21. $5000 at 5 per cent. for 1 month.
22. $2835.20 at 6 per cent. for 2 months.
23. $850 at 6 per cent. for 73 days.
24. $670 at 5 per cent. for 146 days.
25. $785 at 7 per cent. for 219 days.
26. $1[illegible] at 5 per cent. for 75 days.
27. $35[illegible]75 at 6 per cent. for 130 days.

28. $1864 at 7 per cent. for 2 yrs. 245 days.
29. $1684 at 6 per cent. for 1 yr. 280 days.
30. $6500 at 7 per cent. for 3 yrs. 73 days.
31. $1156 at 7 per cent. for 219 days.
32. $4470 at 4 per cent. for 292 days.
33. $1250.26 at 6 per cent. for 1 yr. 146 days.

Find the interest, reckoning **even** months only, of:—

34. $165 at 6 per cent. from Jan. 4 to April 4, 1890.
35. $270 at 7% from June 19, 1890, to Apr. 19, 1891.
36. $1234 at 6% from Apr. 10, 1894, to Oct. 10, 1894.
37. $1895.23 at 6% from June 25, '88, to Mar. 25, '89.
38. $560.60 at 7% from May 5, 1891, to Dec. 5, 1892.
39. $275 at 6% from Jan. 12, 1893, to Nov. 12, 1897.

Find the exact interest of:—

40. $100 at 5% from May 1 to Aug. 10.
41. $500 at 4% from April 2 to June 4.
42. $1375 at 3% from Dec. 1, 1890, to May 1, 1891.
43. $4596.50 at 3% from Dec. 30, '91, to Mar. 31, '92.
44. $1200 at 3% from Jan. 3 to March 15.
45. $4380 at 3½% from Dec. 3, 1885, to Mar. 21, 1887.
46. $3625 at 1½% from Oct. 2, 1885, to May 17, 1887.

C

Rate = *Interest* ÷ (*Principal* × *Time*).

(This will give rate expressed decimally.)

1. (*Sight.*) At what rate of interest has the principal been invested in the following cases:—

If $100 in 1 year gives $10 interest? $7?
If $500 in 2 years gives $60 interest? $25?
If $200 in 3 years gives $24 interest? $60?
If $250 in 8 years gives $25 interest? $150?
If $400 in 3 years gives $60 interest? $45?
If $200 in 2½ years gives $30 interest? $135?

Find the rate of interest:—

2. When the interest on \$700 for 8 yrs. is \$168.
3. When the interest on \$375 for 4 yrs. is \$56.25.
4. When the interest on \$956 for $2\frac{1}{2}$ yrs. is \$119.50.
5. When the interest on \$1421 for $7\frac{1}{2}$ yrs. is \$355.25.
6. When the interest on \$1000 for $12\frac{1}{2}$ yrs. equals the principal.
7. When the interest on \$300 for 9 mos. is \$18.
8. When the interest on \$8450 for 3 mos. is \$147.87$\frac{1}{2}$.
9. When the principal doubles itself in 5 years.
10. When the interest on \$652 for 15 years is \$440.10.
11. When a sum of money is doubled in 16 years.
12. When the interest on \$1728 for 3 months is \$84.
13. When an investment in 5 years yields a sum equal to $\frac{1}{4}$ of the principal.
14. When \$490.62$\frac{1}{2}$ amounts to \$686.87$\frac{1}{2}$ in 8 yrs.
15. When \$500 amounts to \$562.50 in 4 years.
16. When \$105,700 amounts to \$116,270 in 10 years.
17. When \$213.50 amounts to \$266.87$\frac{1}{2}$ in $6\frac{1}{4}$ years.
18. When \$328.80 amounts to \$356.20 in 2 years.
19. When \$311.50 amounts to \$336.42 in 1 yr. 4 mos.

D

Time = *Interest* ÷ (*Principal* × *Rate*).

(Express rate as a fraction, *e.g.*, 5% = $\frac{5}{100}$.)

1. (*Sight.*) For how many years has the principal been earning interest in the following cases:—

\$20 interest, \$300 principal, 2% rate? 3%?
\$90 interest, \$400 principal, 3% rate? 5%?
\$48 interest, \$400 principal, 4% rate? 6%?
\$45 interest, \$450 principal, 10% rate? $2\frac{1}{2}$%?
\$60 interest, \$200 principal, $2\frac{1}{2}$% rate? $7\frac{1}{2}$%?
\$250 interest, \$5000 principal, $2\frac{1}{2}$% rate? 4%?

Find the number of years in which:—

2. The interest on \$1100 at $3\frac{1}{2}$% will be \$115.50.
3. The interest on \$1250 at 6% will be \$187.50.
4. The interest on \$390.62$\frac{1}{2}$ at 4% will be \$46.87$\frac{1}{2}$.
5. The interest on \$4209 at 5% will be \$52.61$\frac{1}{4}$.
6. The interest on \$750 at 4% will be \$20.
7. The interest on \$50 at 5% will be \$100.
8. The interest on \$840 at $2\frac{3}{4}$% will be \$161.70.
9. The interest on \$4212 at $4\frac{1}{6}$% will be \$277.87$\frac{1}{2}$.
10. \$4900 will amount to \$5292 at 4%.
11. \$210 will amount to \$252 at $2\frac{1}{2}$%.
12. A sum of money will double itself at 3%.
13. \$50 will amount to \$85 at 6%.
14. \$1650 will amount to \$1782 at 4%.
15. \$3745 will amount to \$3932.25 at $2\frac{1}{2}$%.
16. \$2416 will amount to \$3050.20 at $5\frac{1}{4}$%.
17. \$500 will amount to \$606.66$\frac{2}{3}$ at $5\frac{1}{3}$%.

E

Principal = *Interest* ÷ (*Rate* × *Time*).

(Express rate as a fraction, *e.g.*, $5\frac{1}{2}\% = \frac{11}{200}$.)

1. (*Sight.*) What is the principal in following cases?
   Interest \$100, rate 1%, time 1 year.
   Interest \$450, rate 5%, time 2 years.
   Interest \$300, rate $2\frac{1}{2}$%, time 6 years.
   Interest \$300, rate 3%, time 4 years.
   Interest \$60, rate $1\frac{1}{2}$%, time 2 years.
   Interest \$270, rate 3%, time 2 years.

Find the principal which will produce:—

2. \$63 interest in $3\frac{1}{2}$ years at 4 per cent.
3. \$60.12$\frac{1}{2}$ in 5 years at 5 per cent.
4. \$70.31$\frac{1}{4}$ in 3 years at 6 per cent.
5. \$62.50 in 5 years at $2\frac{1}{2}$ per cent.
6. \$101.50 in $7\frac{1}{4}$ years at $3\frac{1}{2}$ per cent.

7. 6 cents a day at 6% per annum.
8. $450.66 in 3 yrs. 6 mos. at 6%

Find the principal which will amount to:—

9. $5292 in 2 years at 4 per cent.
10. $267 in $2\frac{1}{4}$ years at 5 per cent.
11. $556.25 in 2 yrs. 3 mos. at 5 per cent.
12. 364.68\frac{3}{4}$ in 5 yrs. 9 mos. at $3\frac{3}{4}$ per cent.
13. $221.07 in 3 yrs. 4 mos. at 7 per cent.
14. $286 in 3 yrs. 4 mos. at 9 per cent.
15. 748.12\frac{1}{2}$ in 3 yrs. 6 mos. at 4 per cent.
16. $287.50 in 2 yrs. 6 mos. at 6 per cent.

Problems in Interest.

1. Find the amount of 140.62\frac{1}{2}$ for 6 years 73 days at 4 per cent.

2. In what time will $1263 double itself at $4\frac{1}{2}$ per cent. yearly?

3. At $\frac{3}{8}$ per cent. monthly, find the simple interest on $25 for 1 year 11 months.

4. In what time will $370 gain $123.33\frac{1}{3}$ at $3\frac{1}{3}$ per cent. per annum?

5. Find the amount of interest to be paid on $200 for 11 mos., $250 for 9 mos., and $300 for 6 mos., at 5%.

6. At what rate per cent. will 70.95\frac{5}{6}$ amount to 78.05\frac{5}{12}$ in $3\frac{1}{3}$ years?

7. If the amount at the end of 4 months at $2\frac{1}{4}$% is $322.40, what was the principal?

8. If the total interest after 7 years at 4 per cent. is 31.26\frac{2}{3}$, what was the principal?

9. In how many years will the interest on $690 become 87.97\frac{1}{2}$ at 3 per cent.?

10. A professorship was founded with a salary of $1250 a yr.; what sum was invested at 6% to produce it?

11. A man has $8000 which he wishes to invest so as to produce $500 a year; what rate must he charge?

12. At what rate of interest must $450 be loaned to gain $56.50 in 1 year 6 months?

13. What sum invested at 1% a month will amount to $500 in a year?

14. How long will it take $350 to gain $350 at 6%?

15. Find the interest of $150 from January 1 to November 20 at 6 per cent.

16. Find the simple interest of $600 for 93 days at 6 per cent.

17. Find the interest of $420 for 73 days at 4%.

18. Find the interest of $1425.20 for 219 days at 3 per cent.

19. What is the interest on a loan of $5800 from Jan. 15 to July 4 at 6 per cent.?

20. A girl is 19 years old. What sum of money must be invested for her at 4% simple interest, that she may receive $405 when she is 21?

21. January 1, 1894, $636 was put out at interest. On September 1, 1895, it had amounted to $678.40. Find the rate of interest.

22. On May 1, 1890, $360 was borrowed at $2\frac{1}{2}$% interest. It remained on simple interest until it amounted to $405. When was the debt paid?

23. A certain sum of money was placed on simple interest at 4% when a child was born. In 25 years it had amounted to $520. What was the original sum?

24. When was $500 put at interest at $5\frac{1}{4}$% if on July 1, 1894, it amounted to 606.66\frac{2}{3}$?

25. How much must be put at interest at 5% to have a monthly income of $100? A daily income of $5?

XVIII.

DISCOUNT.

Discount is a deduction from a stated price, or from a debt paid before it is due.

Bank discount *is simple interest paid in advance.*

Wholesale business houses usually sell goods *on time* and take notes from the retailers in payment. When the holder of a promissory note sells the note to a bank, the sum paid by the bank is called the **proceeds** of the note. The amount deducted from the *face* of the note is the **discount.**

Montreal, 25th January, 1895.

$900.

Forty days after date I promise to pay Gault Brothers or order nine hundred dollars, value received.

Discounted at 6%, Feb. 4th. *JOHN MARTIN.*

Who is the maker of the above note? Who is the payee? What is the face of the note? Is the note negotiable?

Find the day on which it will mature, allowing 3 days' grace. Who discounted the note? How many days had the note still to run when it was discounted?

Find the amount of discount which the bank will deduct from the face of the note.

Find the proceeds of the note. To whom paid?

Who will be responsible to the bank for the payment of the note at maturity? If the note is not paid, what must the bank do?

A

Bank Discount.

1. Find the day of maturity of the following notes, the date of the note and time being given:—

Sept. 7.	Time, 3 mos.	May 18.	Time, 6 mos.
Aug. 19.	Time, 4 mos.	Nov. 29.	Time, 11 mos.
July 27.	Time, 5 mos.	May 30.	Time, 13 mos.

2. Find the day of maturity of the following notes, reckoning exact days:—

Feb. 10.	Time, 10 days.	June 7.	Time, 47 days.
Nov. 23.	Time, 20 days.	April 9.	Time, 70 days.
Aug. 19.	Time, 30 days.	July 3.	Time, 60 days.

3. Find the number of days that the following notes have to run from date of discount to date of maturity:—

Date of note, Aug. 3. Time, 3 mos. Discounted Sept. 15.
Date of note, July 7. Time, 60 dys. Discounted July 7.
Date of note, Sept. 15. Time, 4 mos. Discounted Sept. 21.
Date of note, May 21. Time, 90 dys. Discounted May 29.
Date of note, May 30. Time, 30 dys. Discounted June 15.

Find the day of maturity, the bank discount and the proceeds in the following cases:—

4. A note for $800, dated Feb. 11, 1891, and due in 3 months; discounted two days after date at 7%.

5. A note for $576, dated Oct. 3, and due in one month; discounted Oct. 12 at 6%.

6. A note for $720, dated June 12, 1895, and due in 60 days; discounted July 1 at 5%.

7. A note for $1000, dated 11 March and due in 3 mos.; discounted at date at 6%.

8. A note for $390, dated Oct. 14, and due in 90 days; discounted Nov. 4 at 10%. Fill out this note from yourself to George Ross as payee.

9. A merchant sold goods to the amount of $340, taking his customer's note for that amount due in 3 months without interest. He immediately had the note discounted at the bank at 6%. What did he receive?

10. A merchant bought $6800 worth of goods for cash. He sold them at a profit of 15 per cent., agreeing to accept his customer's note due in 4 months. He immediately had this note discounted at the bank at 6%. Find (1) the face of the note, (2) the proceeds of the note, (3) the merchant's profit.

11. Walter Green bought some goods from Peter Smith on March 15, 1895, giving in payment his note for $500 due in two months without interest. Write out this note. Smith needed the money and had the note discounted on the day it was dated. If the rate of discount was 7%, what sum was received by Smith? Suppose Smith had kept the note till the end of April, and then discounted it, what would he have received?

B

Trade Discount.

1. A tradesman allows a discount of 5 per cent. for cash; what is the cash payment on an account for $210?

2. A tradesman allows a discount of 15 per cent. for cash. Find the cash price of articles marked $5, $3.50, $1.12½.

3. What reduction shall I get from the price of a book published at $1.25, when the bookseller deducts 10%?

4. The list price of a piano is $480. A trade discount of 33⅓ per cent. is allowed and a further discount of 5 per cent. for cash. What is the cash price?

5. What is the net value of a bill of books amounting to $568.50 with 10 per cent. off for cash?

6. What is the net value of a bill of goods amounting to $4372 at 15% discount and 2½% off for cash?

7. Goods are invoiced at $6500, less 8 per cent. and 6¼ per cent. Find the cost.

8. Find the net amount of a bill of $930, discounts being 33⅓, 20 and 2½.

9. List price, $150. Discounts, ⅔ and 17½. Find the cost price.

10. A dealer sold 2631 bushels of wheat at $1.13 a bushel, less 12½%, and 342 tons of hay at $17.50 a ton, less 15%. He allowed a further discount of 5% for cash. Find the net amount of the bill.

11. MONTREAL, April 11, 1896. — Edward Green, Waterloo, bought of Thompson & Co., 36 pairs of boots at $5.17; 216 pairs thick shoes at $1.37½; 135 pairs gaiters at $1.38; 240 pairs buskins at $0.83; 134 pairs slippers at $0.68; 87 pairs rubbers at $1.13. Discounts, 20 per cent and 5 per cent. Write out the above invoice and show net amount of the bill.

12. What is the difference on a bill of $200 between a discount of 30% and discounts of 20% and 10%?

XIX.

PRESENT WORTH.

The **present worth** of a debt is the sum which put at interest is sufficient to discharge the debt when it becomes due.

1. I have to pay $106 in a year from date. What sum of money should I put at interest at 6 per cent. in order to discharge the debt when it falls due?

2. I have the option of paying \$208 a year hence, or \$200 now; which is better, money being worth 4%?

3. A creditor agreed to allow discount at the rate of 5% for the immediate payment of a debt of \$210 due in 1 year. How much would the debtor need to pay?

4. What is the present worth of \$420 due 1 year hence at 5 per cent.? What is the discount allowed for immediate payment?

Find the present worth and true discount of:—

5. \$420 due 3 years hence at 4 per cent.
6. \$1260 due 4 years hence at 3 per cent.
7. \$170.50 due 3 yrs. 5 mos. hence at 4 per cent.
8. \$1018 due 219 days hence at 3 per cent.
9. \$187 due 292 days hence at $2\frac{1}{2}$ per cent.
10. \$322.35 due in 8 months at $3\frac{1}{2}$ per cent.

XX.

COMPOUND INTEREST.

Find the compound interest

1. For 2 years at 5% on \$800; on \$625.
2. For 2 years at 4% on \$375; on \$775.
3. For 2 years at $3\frac{1}{3}$% on \$675; on \$720.

Find the amount

4. Of \$240 in 2 years at 5% compound interest.
5. Of \$1000 in 3 years at 5% compound interest.
6. Find the compound interest on \$100 for $1\frac{1}{2}$ years at 3 per cent. quarterly.
7. What is the compound interest and amount of \$52.62$\frac{1}{2}$ for 3 years at 5 per cent.?
8. Find the difference between the simple and compound interest on \$2000 for 2 years at $6\frac{1}{4}$ per cent.

XXI.

RAPID ARITHMETIC.

A (*Sight*).

A	B	C	D	E	F
53	33	$7.42	$5.86	$86.94	$14.10
95	59	2.19	3.79	73.57	19.80
49	45	7.83	4.00	80.00	94.00
74	38	9.00	2.52	53.78	29.35
87	16	6.48	3.13	45.80	50.47
68	27	8.37	7.75	11.16	18.99

1. Add each number under A separately to each number under B.

2. Find separately the difference between each number under A and each number under B.

3. Add each sum of money under C separately to each sum under D.

4. Find separately the difference between each sum of money under C and each sum under D.

5. Add each sum of money under E separately to each sum under F.

6. Find separately the difference between each sum of money under E and each sum under F.

7. Subtract *sixes* from 100, from 99, from 98, from 97, from 96, from 95, continually till the remainder is less than 6.

8. Subtract *sevens* from 100, from 99, from 98, from 97, from 96, from 95, from 94, continually till the remainder is less than 7.

9. Subtract *eights* from 100, from 99, from 98, from 97, from 96, from 95, from 94, from 93, continually till the remainder is less than 8.

10. Subtract *nines* from 100, from 99, from 98, from 97, from 96, from 95, from 94, from 93, from 92, continually till the remainder is less than 9.

B (*Sight*).

A.	24	36	30	32	28	16	15	25	42	48
B.	14	18	22	27	21	44	40	60	55	35
C.	72	66	54	70	63	56	96	64	81	40
D.	58	39	69	87	59	34	47	86	43	83

1. Multiply each of the above numbers separately by 2, by 3, by 4, by 5, by 6, by 7, by 8, by 9.

2. Multiply each of the above numbers separately by 20, by 30, by 50, by 25, by 100, by 600, by 4000.

3. Find separately 1%, 2%, 7%, 8%, 9%, 10%, 20%, 50%, 25% of each of the above numbers.

4. Multiply each of the above numbers separately by ·5, by ·125, by ·1, by ·001, by ·2, by ·8.

5. Find the cost of articles represented by the above numbers at the following prices:—

\$0.50	each.	\$0.05	each.	\$0.12½	each.	\$0.8⅓	each.
\$0.25	"	\$0.15	"	\$0.37½	"	\$0.16⅔	"
\$0.20	"	\$0.33⅓	"	\$0.62½	"	\$0.75	"
\$0.10	"	\$0.66⅔	"	\$0.87½	"	\$1.25	"

6. Multiply 81·6, ·086, each by 10, by 100, by 1000.

7. Divide 97·8, ·005, each by 10, by 100, by 1000.

8. Multiply 1·6, 6·4, 8·4, ·12, each by 20, by 40, by 50, by 80.

9. Divide 1·6, 6·4, 8·4, ·12, each by 20, by 40, by 50, by 80.

C (*Sight*).

DRILL EXERCISES TO SECURE RAPIDITY AND ACCURACY IN BUSINESS ARITHMETIC.

1. Read the following decimal fractions (*a*) as parts of a dollar, in cents or dollars and cents, (*b*) as rates per cent., (*c*) as common fractions in lowest terms:—

1. ·4.	11. ·825.	21. ·275.	31. 3·125.
2. ·8.	12. ·525.	22. ·15.	32. 8·575.
3. ·6.	13. ·375.	23. ·1.	33. 6·775.
4. ·3.	14. ·975.	24. ·35.	34. 4·925.
5. ·9.	15. ·675.	25. ·475.	35. 1·075.
6. ·7.	16. ·025.	26. ·125.	36. 5·55.
7. ·45.	17. ·85.	27. ·625.	37. 8·2.
8. ·95.	18. ·5.	28. ·175.	38. 7·65.
9. ·75.	19. ·25.	29. ·05.	39. 3·225.
10. ·325.	20. ·425.	30. ·725.	40. 9·875.

2. Find the percentage in following (25 examples):—

Base.	Rate.
1. $100.	(*a*) 5%.
2. $50.	(*b*) 4%.
3. $2000.	(*c*) 10%.
4. $1200.	(*d*) $2\frac{1}{2}$%.
5. $250.	(*e*) 6%.

3. Find the base in the following:—

Percentage.	Rate.
1. $3.	(*a*) 5%.
2. $15.	(*b*) 4%.
3. $0.50.	(*c*) 10%.
4. $2.50.	(*d*) $2\frac{1}{2}$%.
5. $10.50.	(*e*) $12\frac{1}{2}$%.

4. Find the rate % in the following:—

Base.	Percentage.
1. $50.	(*a*) $10.
2. $200.	(*b*) $5.
3. $100.	(*c*) $15.
4. $1000.	(*d*) $25.
5. $2000.	(*e*) $40.

5. Find selling price in following (30 examples):—

Cost price.	Rate % profit or loss.
1. $100.	(*a*) 5% profit.
2. $500.	(*b*) 5% loss.
3. $20.	(*c*) 10% profit.
4. $350.	(*d*) 20% loss.
5. $10.	(*e*) 30% profit.
6. $120.	

6. Find the profit or loss % in the following:—

Cost price.	Gain or loss.
1. $100.	(*a*) $20 gain.
2. $200.	(*b*) $20 loss.
3. $400.	(*c*) $40 gain.
4. $600.	(*d*) $60 loss.
5. $800.	(*e*) $5 gain.
6. $1200.	

7. Find the cost price in the following:—

Selling price.	Rate % profit or loss.
1. $120.	(*a*) 20 p.c. gain.
2. $150.	(*b*) 20 p.c. loss.
3. $300.	(*c*) 25 p.c. gain.
4. $750.	(*d*) 25 p.c. loss.
5. $600.	(*e*) 50 p.c. loss.
6. $3000.	

8. Find the simple interest on (60 examples):—

Principal.		Time.
1. $100	for	(*a*) 5 years at 4 per cent.
2. $300		(*b*) 8 years at 4 per cent.
3. $500		(*c*) 6 years at 3 per cent.
4. $1100		(*d*) 4 years at $2\frac{1}{2}$ per cent.
5. $1200		(*e*) $2\frac{1}{2}$ years at 2 per cent.
6. $50		(*f*) $3\frac{1}{2}$ years at 2 per cent.
7. $150		
8. $250		
9. $1000		
10. $450		

9. Find the time in the following (25 examples):—

Interest.	Principal.	Rate.
1. $45	(*a*) $100	at 1 per cent.
2. $54	(*b*) $300	at 2 per cent.
3. $60	(*c*) $400	at 3 per cent.
4. $90	(*d*) $450	at 4 per cent.
5. $120	(*e*) $400	at $2\frac{1}{2}$ per cent.

10. Find the rate in the following:—

Interest.	Principal.	Time.
1. $25	(*a*) $100	1 year.
2. $45	(*b*) $500	2 years.
3. $30	(*c*) $200	3 years.
4. $150	(*d*) $250	8 years.
5. $135	(*e*) $200	$2\frac{1}{2}$ years.

11. Find the principal in the following:—

Interest.	Rate.	Time.
1. $700	(*a*) 1 per cent.	1 year.
2. $450	(*b*) 5 per cent.	2 years.
3. $300	(*c*) 3 per cent.	4 years.
4. $350	(*d*) $2\frac{1}{2}$ per cent.	6 years.
5. $250	(*e*) $1\frac{1}{2}$ per cent.	2 years.

D

Add vertically and horizontally, without copying down:—

	1	2	3	4	5	6	7
8.	7903	8025	9051	2107	1096	7206	9026
9.	5988	9067	8007	3206	3003	9025	7219
10.	7966	5067	2398	9063	7967	8396	1856
11.	8644	3815	7916	8025	8296	7215	1876
12.	3716	9295	5998	9206	3915	9604	9215
13.	9215	7963	7946	3058	7968	3726	3734
14.	9284	8435	3021	7021	5969	9063	1009
15.	7107	9219	8969	9086	8725	7158	2100
16.	5006	8072	8729	5721	9683	3102	7200
17.	7913	9586	9569	3102	7025	2002	6999
18.	8015	9989	7219	8607	8967	7206	9989
19.	7908	7025	5968	2906	9213	9608	7095
20.	3728	8694	7216	3106	3596	3728	7683
21.	5969	7021	5585	8207	7007	1559	9215

	22	23	24	25	26	27	28
29.	9067	3796	207	5964	2001	9002	5906
30.	569	109	3709	7216	786	2071	909
31.	3021	2906	9216	9608	2907	5968	9909
32.	795	7096	896	3916	726	7219	9999
33.	808	9006	7219	7213	3015	3968	8888
34.	996	5960	3003	9065	990	7965	777$\frac{1}{7}$
35.	5092	7021	2916	7213	7203	8219	6666
36.	7906	9117	707	906	596	2007	5566
37.	769	9009	9061	7908	9603	956	7766
38.	596	3967	729	5968	729	7029	9085
39.	7021	1509	3969	7213	1901	596	703
40.	906	62	501	900	729	7968	37
41.	5986	384	15	7906	839	707	5921
42.	509	1955	7026	512	8879	1906	629

	43	44	45	46	47	48
49.	29061	50216	29113	39061	12345	96044
50.	70635	79613	07029	72096	67891	3726
51.	92186	80156	69031	59185	23456	96921
52.	59147	07007	79163	72096	78912	72156
53.	99081	30916	80217	3095	34567	9213
54.	79698	50911	09056	69002	89123	87215
55.	39091	72196	89215	7358	45678	9061
56.	87296	39167	90061	92015	91234	70123
57.	99896	09026	07213	8017	56789	9686
58.	79684	90766	98175	29163	1237	500
59.	59607	09667	03007	7215	86041	72156
60.	79061	39286	90216	96003	88139	36363
61.	59692	99081	72136	7215	71031	59081
62.	79683	07296	09021	27568	6944	7216

	63	64	65	66	67	68
69.	29137	90716	70140	40317	40211	20191
70.	59038	3824	92382	9856	70130	79386
71.	29537	96864	90368	47256	9035	59406
72.	90613	72196	59376	89666	79032	39601
73.	96928	39185	90213	37694	80965	89063
74.	57216	96072	76384	59465	79632	79158
75.	90317	38067	96058	70315	1560	9091
76.	20313	47215	37213	96018	96876	19090
77.	69681	90516	96474	86219	94032	70215
78.	72136	38296	58169	47206	5968	90217
79.	9063	39285	39467	96081	11411	5038
80.	70031	37216	29606	47216	5917	4715
81.	2931	90213	70915	17129	86928	9624
82.	59368	13729	80706	29615	37169	7968

E

Make out the following bills:—

1. $5\frac{1}{2}$ lbs. cheese at 9¢.
   $3\frac{3}{4}$ lbs. cheese at 8¢.
   16 lbs. 12 oz. bacon at 8¢.
   $14\frac{1}{4}$ lbs. ham at 11¢.
   $9\frac{3}{4}$ lbs. lard at 7¢.
   $8\frac{1}{2}$ doz. eggs at 14¢.

2. $3\frac{1}{2}$ lbs. tea at 40¢.
   $7\frac{1}{4}$ lbs. tea at 46¢.
   21 lbs. sugar at $3\frac{1}{4}$¢.
   $3\frac{1}{2}$ doz. lbs. sugar at $5\frac{1}{4}$¢.
   $6\frac{1}{4}$ lbs. coffee at 20¢.
   9 lbs. cocoa at 19¢.

3. 71 lbs. soap at $3\frac{3}{4}$¢.
   $5\frac{1}{4}$ doz. lbs. soap at $3\frac{1}{2}$¢.
   5 bars do. (each 3 lbs.) at 4¢.
   18 doz. lbs. candles at $6\frac{1}{4}$¢.
   $13\frac{1}{2}$ qts. oil at 6¢ per gal.
   $3\frac{1}{2}$ gross matches at 5¢ per dozen boxes.

4. $3\frac{1}{4}$ yds. calico at 6¢.
   $8\frac{3}{4}$ yds. calico at 8¢.
   $19\frac{1}{4}$ yds. grey calico at 9¢.
   $15\frac{1}{2}$ yds. flannel at 36¢.
   $11\frac{3}{4}$ yds. ticking at 24¢.
   $5\frac{1}{2}$ yds. linen at 28¢.
   $3\frac{1}{2}$ yds. linen at 42¢.

5. 52 yds. alpaca at 19¢.
   3 pieces merino (each $29\frac{1}{2}$ yds.) at 27¢.
   4 pieces poplin (each 156 yds.) at 54¢.
   $14\frac{1}{4}$ yds. lilac silk at $1.40.
   $11\frac{1}{2}$ yds. black silk at $43\frac{1}{2}$¢.
   $3\frac{3}{8}$ yds. satin at $1.50.
   Package, 42¢.

6. 13 lbs. 5 oz. beef at 8¢.
   $11\frac{1}{4}$ lbs. beef at 11¢.
   3 legs mutton (each 8 lbs. 8 oz.) at $9\frac{1}{2}$¢.
   2 shoulders mutton (each 7 lbs. 5 oz.) at 8¢.
   10 lbs. 8 oz. veal at $10\frac{1}{2}$¢.
   $5\frac{1}{4}$ lbs. pork at 7¢.

7. $13\frac{1}{4}$ yds. carpet at 54¢.
   18 yds. drugget at $25\frac{1}{2}$¢.
   $5\frac{1}{2}$ yds. matting at 57¢.
   30 yds. binding at $1\frac{3}{4}$¢.
   $8\frac{1}{2}$ yds. oilcloth at 38¢.
   5 mats at 66¢ each.
   Less discount of $7\frac{1}{2}$ per cent. for cash.

8. 3 vols. Cowper at 60¢ vol.
   3 vols. Longfellow at 42¢.
   1 set Waverley Novels (24 vols.) at $1.02 per vol.
   13 quires foolscap at $8\frac{1}{2}$¢.
   $3\frac{1}{2}$ reams note at 4¢ quire.
   3250 envelopes at 6¢ 100.
   64 five-cent stamps, 54 two-cent do., 152 cent do.

9. 30 lbs. leaf tobacco at 84¢.
8 lbs. 3½ oz. Virginia at 96¢.
15¼ lbs. Virginia at 90¢.
13 boxes cigars (each 3¼ lbs.) at $1.32 per lb.
9 boxes Havanas (each 4 lbs.) at $1.89 per lb.
5% discount for cash.

10. 28 lbs. cut nails at 9¢.
13¼ lbs. cut nails at 10¢.
6 hammers at 70¢ each.
6 chisels at 21¢ each.
13½ gross screws 5¢ doz.
8¼ gross screws 10¢ doz.
1 doz. rakes at 15¢ each.
3 spades at $1.08.
15½ lbs. white lead at 8¢.

F

1. 6963519×8090
2. 6978954×3906
3. 5931768×8009
4. 672976×5006
5. 705968×6069
6. 7215698×5098
7. 99278×8837
8. 928417×8300
9. 6976×6976
10. 3884×3884
11. 9608×9608
12. 5327×5327
13. 8796×8796
14. $694 \times 694 \times 694$
15. $765 \times 765 \times 765$
16. $308 \times 308 \times 308$
17. $8907 \times 8907 \times 8907$
18. $6009 \times 6009 \times 6009$
19. $9876 \times 9876 \times 9876$
20. 967188×34562
21. 5990880×409006
22. 2340600×607098
23. $2159063 \div 729$
24. $926104513 \div 217$
25. $371321617 \div 546$
26. $70213169 \div 947$
27. $61201793 \div 795$
28. $713061311 \div 864$
29. $49031702 \div 979$
30. $47603136 \div 847$
31. $5956982 \div 861$
32. $12345608 \div 987$
33. $39176034 \div 5968$
34. $72041358 \div 9215$
35. $2030405 \div 4725$
36. $4372851 \div 6104$
37. $192736653 \div 3856$
38. $615274528 \div 7648$
39. $70605049 \div 8570$
40. $467817938473 \div 2100$
41. $367817938429 \div 36500$
42. $267817938115 \div 1360000$
43. $1,000,000,000,000,000 \div 81111, 11111.$

MISCELLANEOUS EXAMPLES.

A (*Simple Rules*).

1. Find the sum of all the numbers between 897 and 904.

2. The product of two numbers is 252 and the multiplier is 18; find the multiplicand.

3. The sum of two numbers is 250 and their difference is 50. Find the numbers.

4. The less of two numbers is contained 14 times in 252; the greater is 49 times the less. Find the numbers.

5. What number multiplied by 789 gives 3771420?

6. Divide 900 into two parts so that one may be 62 more than the other.

7. Express in words the following numbers:—70070, 707, 5706, 9011610, 3210, 10176, 40400.

8. Take thirty-seven millions thirty-five thousand six hundred and eighteen from 110011007; and give the result in words.

9. How many dozen are there in 126 score?

10. Multiply half of 1162 by twice the third part of 402.

11. The sum of 250 and 173 is multiplied by their difference, and the product divided by 45; what is the quotient?

12. If every page of a book contains 36 lines and each line on an average 11 words, how many pages will be filled with 62172 words?

13. I multiply a number by 36 and divide the result by 12 and obtain 374181. What is the number?

14. What number must be added to 32684 to make it exactly divisible by 126?

15. What number must be subtracted from 461633 to make it exactly divisible by 758?

B *(Common Fractions)*.

1. Find the sum of $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$ and $\frac{1}{6}$.

2. From ($\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$) take ($\frac{1}{3}$ of $\frac{3}{8}$).

3. Multiply the sum of $\frac{1}{7}$ and $\frac{1}{8}$ by their difference.

4. By how much is $1\frac{3}{5}$ of 15 greater than $14\frac{1}{2} \times 1\frac{1}{2}\frac{9}{0}$?

5. At $\$3\frac{1}{4}$ a day, what can a man earn in $25\frac{1}{2}$ days?

6. The dividend is $42\frac{3}{4}$, quotient $8\frac{1}{2}$; find the divisor.

7. A farmer bought a cow for $\$26\frac{2}{3}$ and some sheep for $\$52\frac{1}{2}$; what change from a \$100 bill?

8. How much longer is 6 feet than $\frac{1}{6}$ of a foot?

9. What must be added to $(3\frac{1}{5} - 2\frac{7}{8} + 4\frac{1}{1}\frac{1}{0})$ to make $8\frac{1}{4}$?

10. How many times is $(3\frac{3}{8} - 1\frac{3}{4})$ contained in $5\frac{1}{5} \times 1\frac{7}{8}$?

11. What must be subtracted from $(7\frac{1}{8} \div 6\frac{1}{3})$ to leave $\frac{1}{2}$?

12. By how much does $7\frac{1}{5}$ divided by $6\frac{3}{1}\frac{3}{0}$ exceed $6\frac{3}{1}\frac{3}{0}$ divided by $7\frac{1}{5}$?

13. $16\frac{2}{3}$ is $\frac{1}{6}$ of what number?

14. $18\frac{3}{4}$ is $\frac{3}{1}\frac{3}{6}$ of what number?

15. $\frac{5}{1}\frac{5}{6}$ of a ship cost \$8360; what is the ship worth?

16. I spend $\frac{7}{9}$ of my money and have \$18 left; what had I at first?

17. After walking $12\frac{3}{4}$ miles I have still $\frac{1}{2}\frac{7}{0}$ of my journey to travel. How long is my journey?

18. When 24 lbs. have been taken from a chest of tea it is $\frac{1}{1}\frac{1}{4}$ full. What was the weight of the tea?

19. If I buy $\frac{1}{1}\frac{1}{6}$ of a ship and sell $\frac{2}{3}$ of what I buy, what part of the ship shall I still own?

20. After spending $\frac{3}{5}$ of my money and losing $\frac{1}{8}$ of the remainder, I have \$21 left. What had I originally?

21. I pay $\frac{2}{5}$ of a debt in silver, $\frac{3}{8}$ in gold and the remainder with 36 one-dollar bills. What was my debt?

22. A gets $\frac{8}{1}\frac{8}{5}$ of an estate worth \$4000, B $\frac{3}{7}$ of the remainder, and C what is left. How much does each get?

C (*Decimals*).

1. What is meant by the term "decimal fraction"?
2. Express in words ·5132.
3. Express as common fractions ·031, ·0079, ·001, 7·103.
4. Divide ·031 by 10, and 1·037 by 1000.
5. From 1 take ·0031, multiply the remainder by ·07.
6. Divide the sum of 8·25 and 4·125 by their difference.
7. How many times can ·125 be taken from 10?
8. What decimal represents the difference between $\frac{1}{3}$ and $\frac{4}{11}$?
9. Add \$·375 + \$·9604 + \$5·906 + \$30·125.
10. Add $\frac{·63}{5·6}$ to $\frac{9·9}{·36}$.
11. From $\frac{5\frac{1}{2}}{·88}$ take $\frac{·084}{10·5}$.
12. From $\frac{·57}{·76}$ take $\frac{·91}{5·2}$.
13. Find the product of the two smallest decimals that can be expressed by the figures 0, 0, 9 and 3.
14. Divide 429 hundredths by 5 millionths and from the quotient subtract 425 thousandths; express the result as a common fraction in lowest terms.
15. Cost of 6284 feet of lumber at \$12.35 a thousand?
16. Cost of 3684 lbs. of pork at \$9.24 a hundred?
17. One hundred and eight steps, each ·58$\frac{1}{3}$ feet high, lead to the summit of a tower. What is its height?
18. The height of a dwarf is ·1875 of that of a giant who is 8·88 ft. high. What is the dwarf's height?
19. A person owns ·675 of a business worth \$47,500. What should he receive for ·375 of his share?
20. Simplify $\frac{2·46 + 3\frac{3}{4}}{3·575 + 1\frac{1}{8}}$ and give answer as a decimal.

D (*Compound Quantities*).

1. Reduce 1 mi. 879 yds. 2 ft. to feet.

2. Reduce 413419020 seconds to years.

3. A boat race started at 2 hrs. 12 min. 11 sec. and finished at 2 hrs. 31 min. $5\frac{1}{2}$ sec.; how long did it last?

4. Three gardeners rent $5\frac{1}{2}$ ac. of ground; one has $1\frac{1}{4}$ ac. and another 7216 sq. yds. How much has the third?

5. If sound travels 1130 feet a second, how long does it take to travel 226 miles?

6. What is the total length in yards, feet and inches of 770 pieces of string each 29 inches long?

7. From a plank measuring 19 ft. 6 in. there is cut away $2\frac{1}{3}$ of $\frac{3}{5}$ of the whole. What length remains?

8. How many sixteenths of an inch in $1\frac{1}{4}$ yards?

9. Value of 7·125 of £5. 4s.

10. The cost of a cable message is 9d. a word; how many words can be sent for £1. 3s. 3d.?

11. Add together $\frac{1}{8}$ of a bushel, $\frac{3}{4}$ of a peck, $\frac{1}{4}$ of 24 bushels, and $\frac{1}{2}$ of 7 bu. 3 pks. 4 qts.

12. Find the exact number of days between April 10, 1890, and Aug. 25, 1891.

13. How many times round a garden 90 feet long 42 feet wide will make a walk of 3 miles?

14. A ship sailing westward reached a point where its chronometer at noon showed the time at Greenwich to be 6 hrs. 48 min. 28 sec. P.M. Find the longitude.

15. When it is noon at Montreal, long. 73° 25′ West, what is the time in Paris, long. 2° 20′ East?

16. A circular track is 600 yards round; A runs twice as fast as B; A and B start from the same place in opposite directions, and they meet in 45 seconds. How long would B take to run a mile at the same rate?

E (*Proportion*).

1. If I walk 21 miles in 5 hours, how far do I walk in 2 hours?

2. If 55 quires of paper are used in 18 days, how long will 33 quires last?

3. While a wheel 15 feet in circumference turns 400 times, how often does a wheel 12 ft. in circumference turn?

4. If 75 lbs. of tea last 8 persons for a year, for how many days will 45 lbs. last them?

5. If 75 lbs. of tea last 8 persons for a year, how many lbs. will be required for 146 days?

6. If 75 lbs. of tea last 8 persons for a year, how many lbs. will be required for 12 persons?

7. If 75 lbs. of tea last 8 persons for a year, for how long will they last 20 persons?

8. If 75 lbs. of tea last 8 persons for a year, for how many persons will 600 lbs. suffice?

9. If 75 lbs. of tea last 8 persons for a year, how many persons will they last for 292 days?

10. If 25 men do a piece of work in $3\frac{1}{5}$ hours, how many can do the same work in $6\frac{2}{3}$ hours?

11. A bankrupt pays $66\frac{2}{3}$ cents on the dollar. His assets are worth \$452.50. What does he owe?

12. What does a bankrupt pay on the dollar, if his creditors receive \$850, and his debts are \$3000?

13. A person travels 109 miles in 36 hrs. 20 min.; in how many hours will he travel 50 miles?

14. If the price of a score articles exceeds the price of a dozen by \$2, what would be the price of 3 score and 10?

15. Nineteen men perform a certain piece of work in 76 days of 7 hours each; how many men would be required to do it in 133 hours?

F (*Mensuration*).

1. A garden fence is 63 yds. long and 9 ft. 4 in. high; what will it cost to paint it on both sides at 11 cents a sq. yard?

2. How many boards 12 ft. 6 in. long by 9 in. wide would be required for a room $11\frac{1}{4}$ ft. by 10 ft.?

3. The walls of a room 15 ft. long by 14 ft. 6 in. broad and 8 ft. 6 in. high are to be painted, a window 5 ft. 6 in. by 4 ft., and a fireplace 3 ft. 6 in. by 4 ft. being deducted. How many sq. yds. of surface are to be painted?

4. What is the area of a piece of land in the form of a rhomboid 200 ft. long, if the distance between the parallel sides is 90 ft.?

5. Find area of blackboard surface in your room.

6. How many times will a wheel $3\frac{1}{2}$ feet in diameter turn in going $2\frac{1}{2}$ miles?

7. In going a certain distance a wheel $4\frac{1}{3}$ feet in diameter makes 1430 revolutions. What is the distance?

8. If the equator is 25211·34 miles in circumference, what is the length of the diameter of the earth?

9. The radius of a semicircular flower-bed is 20 feet; find its area.

10. Find the capacity of a round basket 20 in. in diameter and 28 in. deep.

11. Find the solidity of a prism whose base is 6 feet square and height 15 feet.

12. Of two pieces of land, the one a circle 18 rods in diameter, the other a triangle whose base is 24 rods and height 18 rods, which is the larger and how much?

13. What is the area of a triangular field whose base is 325 yards and perpendicular height 160 yards. Express in acres and square yards.

G (*Metric System*).

1. What is the price of a can of coffee containing 47¼ Kg. at 2·20 francs the Kg. ?

2. If the average weight of 5 packages is 4·625 kilos, and the weights of four of them are 3·675 kilos, 8·675 kilos, 2·25 kilos, and 7·725 kilos; what is the weight of the fifth ?

3. If I walk 6·056 Km. in an hour, how far shall I go in 6 hrs. 48 min. ? How many miles shall I go, allowing a kilometre to be ⅝ of a mile ?

4. From 19·06 Km. take 354·406 m.

5. At 7¢ a litre, what will a decalitre of milk cost ?

6. A druggist put up half a kilo of opium in boxes containing 1½ grams each. How many boxes did he need?

7. How many grains of opium did each box contain ?

8. A litre of air weighs 1·3 grams; what will be the weight of air in a room 3 m. long, 2½ m. wide and 2 m. high?

9. Into how many lots of 3·75 a. may 8·40 Ha. be divided ?

10. A vessel when empty weighs 1·02 Kg.; when full of pure water it weighs 3·8 Kg. Find the capacity of the vessel in litres.

11. A train which travels 56·25 kilometres an hour take 3¼ hours between two stations What is the distance between them in metres ?

12. I can buy 526·2 kilos at $157.15 the kilo; what would be the price per kilo, if I bought 1841·7 kilos for the same money ?

13. A man cut 75·60 m. of wire into pieces each 25 mm. long, and sold them at 6¢ a doz. ; how much did he receive?

14. A cask weighs 227·5 Kg. more full than empty; how many Hl. will 29 such casks hold ?

H (*Percentage*).

1. In a shipwreck 45 people are lost out of 180; what per cent. is saved?

2. If a person spend 10% of his income in rent, what has he left out of \$460 per annum?

3. In 1880 the population of a town was 129,181, and in 1890 the population was 113,387. Find the decrease per cent.

4. The population of a city increased from 401,321 to 460,428; find the rate per cent. of increase.

5. Find the prime cost of an article which, when sold for \$24, yielded a profit of 20%.

6. What per cent. of $2\frac{1}{2}$ is $1\frac{1}{3}$?

7. What is $\frac{7}{8}$% of \$1728?

8. What is the difference between $5\frac{1}{2}$% of \$800 and $6\frac{1}{2}$% of \$1050?

9. A man received from a bankrupt \$397.50, which was $37\frac{1}{2}$% of the sum due. What was his loss?

10. For what price per pair must shoes be sold to gain 25%, if 15% is lost when they are sold at $\$1.27\frac{1}{2}$ per pair?

11. A man owning 40% of a ship sold 25% of his share for \$4500. What was the ship worth?

12. A sold two lots for \$260 each, gaining 20% on one and losing 20% on the other. Did he gain or lose on the whole transaction, and how much?

13. A buys a horse for \$60 and sells it to B for \$120, who sells it for \$200; how much per cent. did A gain more than B?

14. Bought 60 barrels of flour at \$8.50 a barrel. Half was sold at a loss of 10%, and the remainder at \$9 a barrel. Find the actual loss and the loss per cent.

I (*Interest and Discount*).

1. Interest on \$290 for $11\frac{1}{2}$ years at $2\frac{1}{4}\%$.

2. Interest on \$500 from May 15 to Nov. 27 at 6%.

3. At what rate per cent. will \$5000 amount to \$5400 in 1 year 219 days?

4. At what rate per cent. will the simple interest on \$300 amount to \$36 in 4 years?

5. In what time will the simple interest on \$550 amount to \$88 at 4%?

6. In what time will \$6060 amount to \$6696.30 at 3 per cent. per annum?

7. What principal will produce \$50 in 4 years at $2\frac{1}{2}$ per cent. simple interest?

8. What principal will amount to \$377 in 4 years at 4% simple interest?

9. For how much a month should I rent a house that cost \$3200, so as to receive 6% per annum?

10. Find the net amount of a bill of goods, the list price of which is \$435, discount 8% and 5% off for cash.

11. On a bill of \$625 what is the difference between a discount of 30% and a discount of 25% and 5%?

Find the proceeds and discount on

12. A note for \$700 drawn Nov. 13 at 90 days, discounted Jan. 1 at 7%.

13. A note for \$500 drawn July 9 at 90 days, discounted at date at $3\frac{3}{4}\%$.

14. A note for \$400 drawn March 3 at 8 months, discounted June 13 at 4 per cent.

15. Find the amount at compound interest on \$89.50 in 3 years at 5 per cent.

16. Find the difference between the simple and compound interest on \$5000 for 2 years at 4 per cent.

XXII.

TEST EXERCISES (*Mental*).

1. What is the largest number that can be formed by the figures 6, 0, 7, 4?

2. How many apples must be cut up to give 300 boys $\frac{2}{3}$ of an apple each?

3. Multiply 30 by 4, subtract 50, add 10, divide by 5, multiply by 7.

4. The remainder is 5, quotient 6, divisor 7. Find dividend.

5. A woman bought 13 yards of goods at 30 cents a yard. What change did she receive out of a $5 bill?

6. I divide 25 oranges between 2 boys, giving one 7 more than the other. How many did each receive?

7. What part of 10 miles is $\frac{1}{2}$ of 8 miles?

8. A horse costing $60 is sold for $75. What part of the outlay is the gain? What per cent.?

9. If 8 pts. of berries cost 32¢, what will a peck cost?

10. A marketwoman having 6 doz. eggs broke 9 and sold the remainder at 20¢ a doz. What did she receive?

---

1. How many days from April 24 to June 19?
2. What will a boy earn in 98 hrs. at 15¢ an hr.?
3. Prime factors of 210.
4. Express $\frac{1}{2}$ of one-hundredth as a decimal.
5. Difference between $2\frac{1}{2}\%$ and $3\frac{1}{2}\%$ of $800.
6. Value of $\frac{7}{9}$ of a dollar.
7. Express $\frac{3}{4}$ of a dollar as a decimal of $\$2\frac{1}{2}$.
8. Interest on $40 for $2\frac{1}{2}$ years at 5%.
9. Divide 54·8 by 100.
10. Bought goods for $\$2\frac{1}{2}$ and sold for $3. Gain %?

1. At 15¢ a yard, how much can be bought for $3?

2. From a piece of cloth $\frac{1}{3}$ and $\frac{1}{2}$ of it have been cut. What part of it is left?

3. Four cents a pint. How much per gallon?

4. What part of 100 is $12\frac{1}{2}$? What per cent.?

5. By selling a hat for $5.40 I gain 20%. How much do I gain?

6. I borrow $500 at 6% and pay it back at the end of 9 months. What sum must I return?

7. I bought 40 yds. of carpet at 75¢ a yd. After using it 5 yrs. I sold it for $15. If the carpet was worth $3 a year to me while I used it, what did I gain or lose?

8. What is $\frac{3}{5}$ of $\frac{2}{3}$ of $10?

9. Bring $1\frac{7}{8}$ to a decimal.

10. Express 3 ounces as a fraction of 7 lbs.

---

1. Exchanged 11 tons of hay for 15 yds. of cloth at $6 and 4 yds. at $5. What is the hay worth a ton?

2. How long will it take 11 men to do what 10 men can do in 11 days?

3. In a certain school there are 20 boys and $\frac{7}{4}$ as many girls. Required the total number of pupils.

4. How many steps, each 2 feet long, will a child take in walking 110 yards?

5. A boy can pick 3500 stones off a summer fallow in a day. At 20¢ per m. how much will he earn in a week?

6. A man bought some apples for 88¢ at the rate of 5 for 11¢, and divided them among his 4 children. How many did each child receive?

7. $3 + \frac{1}{8} + 2 + \frac{1}{2}$.

8. From 3·5 take 1·75.

9. What is ·125 of a dollar?

10. Interest on $44 for 3 years at $2\frac{1}{2}$%.

1. Multiply 16 by 12, add 8, divide by 400, multiply by 128.

2. At $16 acre, what will 2 ac. 40 rods of land cost?

3. I buy 108 articles at 9¢ for every 12, and pay for them with a $2 bill. What change should I receive?

4. The difference in lbs. between $\frac{1}{2}$ cwt. and $\frac{1}{3}$ cwt.

5. Bought 4 bushels of nuts at $12\frac{1}{2}$ cents a peck. Gave $2 bill. What change?

6. Apples costing 2¢ each are sold for 3¢. Gain %?

7. What is ·4 of a dollar?

8. Interest on $50 at 5% for 5 years.

9. $\frac{3}{4}$ of a cent is what decimal of a dollar?

10. 5 oranges cost $7\frac{1}{2}$¢, what will 3 cost?

---

1. If a plant doubles its number of blossoms every year, and has two blossoms the first year, how many blossoms will it have the fifth year?

2. How many square tiles 6 inches on a side will be required to make a hearth 4 ft. by 2 ft.?

3. From $\frac{3}{4}$ of a cask $\frac{2}{3}$ of the cask is drawn off. If the cask holds 48 gallons, how many gallons remain?

4. Bought 3 quires 12 sheets of paper at 25¢ a quire. What change from a dollar?

5. A quantity of sugar which weighed 900 lbs. lost 6% in drying. What did it then weigh?

6. If you buy a knife for 50¢ and sell it for 60¢, what per cent. of the cost do you gain?

7. A flight of stairs consists of 20 steps. Each step is 6 inches high and 12 inches broad. How many yards of carpeting will be required to cover the stairs?

8. What per cent. is 5 of 75?

9. Amount of $1000 for 10 years at 5%.

10. From 8 times the half of 17 take $4 \times 4 \times 4$.

1. Add 5, 18, 23, 7, 9, 14, 19, 3, 35.

2. Bought pencils for $1.25 a gross and sold them at a cent each. What was the gain on 10 gross?

3. If 20 men do a piece of work in 15 days, how long will it take 12 men to do it?

4. A man owns $\frac{3}{8}$ of an estate and gives his son $\frac{1}{3}$ of his share; what part of the estate has he then left?

5. Which is greater and by how much, $\frac{1}{2}$ yd. or $\frac{2}{3}$ yd.?

6. How many lbs. sugar at $9\frac{1}{2}$¢ can be bought for $3.80?

7. ·075 ÷ ·5.

8. Apples are 5 for 4¢. How much per doz.?

9. Cost of $6\frac{1}{2}$ yds. ribbon at $6\frac{1}{2}$¢ a yd.?

10. How many sq. metres in the walls of a room 12 m. long, 8 m. wide and 6 m. high?

---

1. If a horse eats $\frac{1}{2}$ peck of oats each day, how long will 7 bushels last?

2. $\frac{1}{3}$ of a pole is in water. The part above water measures 24 ft. What is the length of the pole?

3. Three men did a piece of work. The first did ·37 and the second ·33 of it. What part did the third do?

4. The product of the sum and difference of 18 and 12?

5. If the rent of a store for 30 days is $90, how much will it be for 17 days?

6. A careless pupil wrote ·7 instead of ·07. What was the amount of his error?

7. A man sold something that cost him $240 at a loss of 25%. What was the selling price?

8. 4 cwt. of coal at $7.50 a ton. Change from $2.

9. If 60 lbs. cost 84c, what will 65 lbs. cost?

10. How many cubic decimetres in a rectangular stick 4 dm. square and 50 dm. long?

1. A piece of work is done in 4 days of 12 hours each; how long will it take when the days are 8 hours?

2. I pay away $\frac{1}{2}$ my money and then $\frac{1}{4}$ of what remains, and have \$3 left. How much had I at first?

3. The four sides of a square room together measure 48 feet. Find its area in sq. yards.

4. Bought an article for \$8 and sold it for \$7. What is the loss per cent.?

5. A man sells 60 sheep. This number is $66\frac{2}{3}\%$ of his flock. How many sheep in the flock?

6. Cost of 2 gross slate pencils at 3 for a cent?

7. In ·75 of a mile how many yards?

8. What is \$250 less 1% of \$250?

9. On \$50 I gain ·5 of \$10 in ·5 of a year. Find rate.

10. How many cubic metres in a cellar 20 m. long, 8 m. wide and $2\frac{1}{2}$ m. deep?

---

1. Cost of 19 tons 1000 lbs. of coal at \$6 a ton?

2. How many minutes in a day?

3. A farmer put 1200 bushels of wheat into 480 bags of uniform size. How much did he put into each bag?

4. An iron bar weighing 12 lbs. 8 oz. is made into 5 equal bolts worth 4¢ a lb. What is each bolt worth?

5. How much per dozen is $87\frac{1}{2}$¢ per pair?

6. What must be added to $\frac{1}{3}$ of $2\frac{1}{7}$ to make 1?

7. An assembly hall contains 20 rows of 15 seats each, and 30 rows of 5 seats each. How many will the hall seat?

8. A woman is 42 years old, which is $\frac{6}{7}$ of her husband's age. How old is he?

9. At 25¢ a sq. foot what is the cost of a piece of ground 20 feet front and 40 feet deep?

10. A regiment of 800 men lost 8% of its number. How many remained?

1. How many times will a wheel, 10 feet in circumference, turn in going half-a-mile?

2. By selling goods at $7.20 I make a profit of 20 per cent. What did I give for them?

3. What is that number of which, if 8 be added, and the sum divided by 3, the quotient will be 12?

4. At 37½¢ a yard, how many yards of lace can be bought for $5¼?

5. How many hours from noon of the 4th to midnight of the 7th July?

6. If 20% be lost on a ton of hay sold for $19.20, what was the cost of the hay?

7. What will a mile of wire cost at a cent a foot?

8. Two men chop 20 cords of wood in 4 days. How many men can chop half the wood in half the time?

9. Interest on $150 for 7 years at 4%.

10. A man lends $900 for 73 days at 5%. What interest should be receive?

---

1. 225 is 25 per cent. of a certain number. What is the number?

2. Sugar weighing 900 lbs. lost 10% in weight in drying. What will it bring at 5¢ a lb.?

3. Cost of 250 lbs. of ice at $4.80 a ton?

4. $25 less 4%.

5. $350 plus 3%.

6. What is $\frac{11}{10}$ short of 20?

7. Express 7 cwt. as a common fraction and as a decimal of a ton.

8. What per cent. is 8 of 60?

9. How many times is ·15 contained in 6?

10. From $\frac{3}{4}$ take $\frac{3}{5}$ and express answer as a decimal

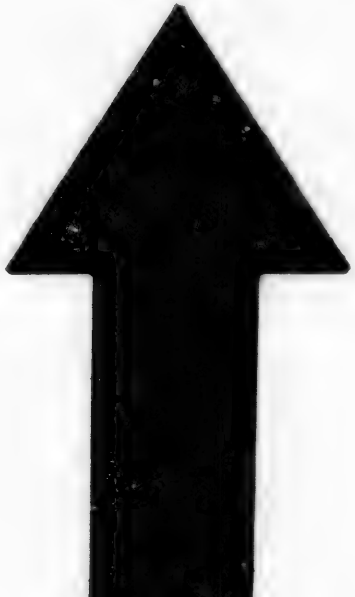
1. Reduce 6 pecks to fraction of 1 bushel.
2. Express $\frac{3}{5}$ as a decimal.
3. Interest \$84, 7%, 1 year. Find principal.
4. Principal \$200, amount \$400, 8%. Find time.
5. Multiply 3·5 by 1·2.
6. From $\frac{3}{5}$ of \$10 take $\frac{1}{4}$ of \$8.
7. Interest is \$3 at 4%. How much at 3%?
8. $\frac{7}{10}$ of 2 minutes.
9. $\frac{3}{10}$ of 2 days.
10. How many hours in 2·25 days?

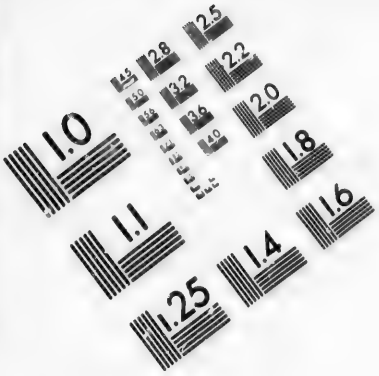
---

1. 19 + 29 + 39 + 49 =
2. Express $\frac{1}{4}$ yard as the fraction of a rod.
3. How much is 20 times $\frac{1}{6}$ of 10 cents?
4. Bought an apple for 1¢, sold for 1½¢. Gain %?
5. Take ·75 from $\frac{3}{2}$.
6. 2500 marbles at \$1.60 a thousand.
7. Express ·725 as a common fraction.
8. $\frac{2}{3}$ acre is worth \$120. What for $\frac{1}{2}$ acre?
9. From ·07 take ·007.
10. Interest \$50, rate 5%, 4 years. Find principal.

---

1. Divide $\frac{1}{3}$ of 1347 by $\frac{1}{2}$ of 449.
2. What is 500 less 3%?
3. 2 gross pens at 9½¢ a dozen.
4. At 22 cents a lb., how much for 2 oz.?
5. How long will it take \$300 to double itself at 5%?
6. How many five-cent pieces in ·25 of \$8?
7. How many inches in 3·75 yards?
8. Amount of \$400 for 4 years at 3½%.
9. If $\frac{3}{5}$ of a house cost \$6000, what for the whole?
10. Divide $\frac{2}{3}$ of $\frac{4}{7}$ by $\frac{3}{5}$.





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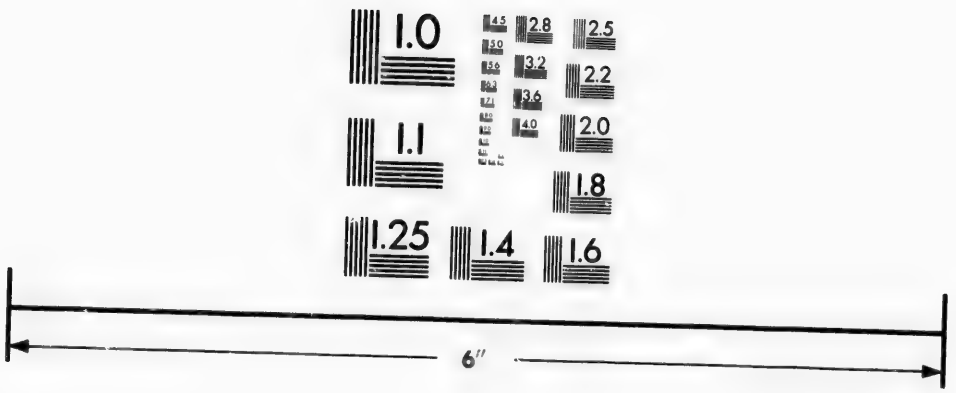

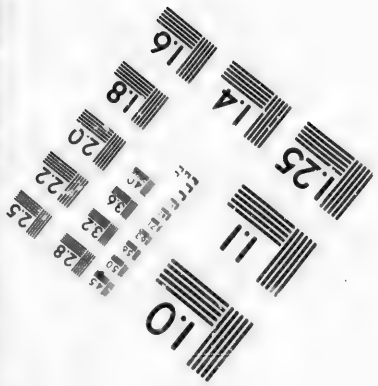

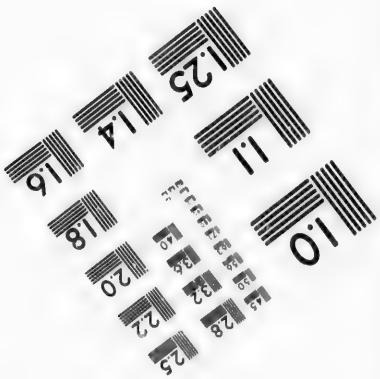

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XXIII.

TEST PAPERS.

A

1. What number contains 3756 exactly $13\frac{1}{2}$ times?

2. Cost of $75\frac{1}{2}$ doz. eggs at two for $1\frac{1}{2}$ cents.

3. How many sleepers, each 3 ft. apart, would be required for a double line of rails $3\frac{1}{2}$ miles long?

4. Cost of 11 yds. 2 ft. 6 in. of iron palisades at $3.75 a yard?

5. If 35 workmen can do a piece of work in 18 days, how long would it take 210, working only half as quickly?

6. How many bricks, each 9 in. by $4\frac{1}{2}$ in., will pave 3 courtyards, each 81 feet square?

B

1. If a man walks $8\frac{4}{7}$ miles in $2\frac{1}{2}$ hours, how far can he walk in $3\frac{1}{2}$ hours?

2. How much greater is the area of a lot 50 rods square than of a lot containing 50 sq. rods?

3. A farmer sold in a week 5·825 tons of hay. On Monday he sold 1350 lbs.; on Tuesday, $\frac{1}{2}$ ton; on Wednesday, $1\frac{1}{8}$ tons; on Thursday, 1·415 tons; and on Friday, $1\frac{3}{4}$ tons. How much did he sell on Saturday?

4. Express 2 ft. $7\frac{1}{2}$ in. as the fraction of 100 yds.

5. $1\frac{9}{11} - (\frac{1}{3}$ of 4).

6. In a school numbering 200 the daily attendance is 160. What is the per cent. of attendance? The number absent is what per cent. of the number present?

C

1. A train travels $9\frac{1}{4}$ miles in ten minutes; how far will it go in 1 hr. 45 min.?

2. Multiply the half of $7\frac{1}{4}$ dollars by 7.

3. Divide 3 times the half of 1108 by 5 times the fourth part of 7 times 16.

4. From \$3·1475 take \$3·10475 and reduce the remainder to the decimal of 50 cents.

5. If a person receiving \$42 a week gets an advance of 15%, what will he then receive?

6. Find the area of a triangle whose base is 9 ft. 8 in. and perpendicular height 5 ft. 3 in.

D

1. $\frac{3}{5}$ of a week + $\frac{3}{4}$ of a day + $\frac{3}{8}$ of an hour.

2. What fraction of 25 lbs. is 3 lbs. 2 oz.? What per cent.? What decimal?

3. If $\frac{5}{6}$ of a yard of ribbon cost $\$\frac{7}{8}$, what will be the price of $5\frac{2}{3}$ yards?

4. A man earns \$2.75 a day. How much will he earn in July, the first day of which is Thursday?

5. Find $\frac{3}{4}$ of 8 tons 16 cwt. $24\frac{3}{4}$ lbs.

6. ·475 cwt. + ·75 lb. + ·125 oz.

E

1. What is the profit on the sale of 7 gross, 3 score and $3\frac{1}{2}$ dozen newspapers at one cent each, if they are bought at $8\frac{1}{2}$ cents a dozen?

2. In a town containing 11,500 inhabitants there are 22 deaths and 73 births per year in each thousand. What will be the increase in 20 years?

3. A field of 7 ac. 80 rods is rented for \$37.50. How much is that for 19 ac. 120 rods?

4. Simple interest of \$720 from March 11 to July 9 at $7\frac{1}{2}$ per cent.

5. Take $2\frac{3}{5}$ from the sum of $5\frac{5}{9} + 7\frac{4}{11} + 3\frac{6}{7}$.

6. How many yds. of carpet a yard wide for a room 27 ft. long, 21 ft. 3 in. broad, if strips run across room?

F

1. Value of $\frac{\frac{1}{4} \times 1\frac{3}{5}}{\frac{3}{5} \times \frac{1}{6}}$ of 21.

2. Gained $12\frac{1}{2}\%$ by selling eggs for $\frac{3}{4}$ cent apiece. What was the cost price per dozen?

3. How many pieces, each measuring $2\frac{1}{4}$ inches, can be cut from 90 yards?

4. Rent of a house for 5 wks. at $260 a year?

5. Express $\frac{3}{4}$d. as the decimal of £1.

6. A square court whose side is 42 yds. is paved with 28,224 square tiles. Find the dimensions of each tile.

G

1. Cost of $700\frac{1}{2}$ feet of boards at $22.50 a thousand.

2. Cost of ·725 of a ton at $8 a cwt.

3. What is the profit per cent. on goods bought for $11\frac{2}{3}$ and sold for $14?

4. What is the weight in lbs. of the contents of a box 5 feet long, 4 feet broad and 3 feet deep, if 60 cubic inches weigh 9 ounces?

5. What is the total surface of a cube, the edge of which measures $4\frac{1}{2}$ inches?

6. What sum put at interest at $7\frac{1}{2}\%$ will amount to $2500 in $3\frac{1}{3}$ years?

H

1. Bought 15 cwt. 22 lbs. of rice at $4.25 a cwt., and 6 cwt. 36 lbs. of barley at $5.60 a cwt. What will be gained by selling the whole at $6\frac{1}{4}$¢ a lb.?

2. A merchant sells cloth at $3.60 a yard, gaining 20%. At what price must he sell to lose 15%?

3. How much will it cost, including waste, to carpet a room 18 ft. square with carpet $\frac{5}{8}$ yd. wide, at $1.50 a yd.?

4. Five cents a day is the interest on what sum at 7 per cent. per annum?

5. The sum of two numbers is 1876. The greater is three times the less. Find the numbers.

6. From sixteen ten-thousandths take 27 millionths, and multiply the difference by 20·5.

I

1. By how much does the difference between $5\frac{2}{3}\frac{3}{2}$ and $2\frac{3}{7}$ exceed the sum of $\frac{5}{8}$, $\frac{5}{1\,4}$ and $\frac{1}{6}$?

2. Add by decimals $\frac{3}{4}$, $\frac{7}{1\,6}$, $\frac{7}{8}$, ·65, ·375.

3. If $\frac{1\,1}{1\,8}$ cwt. cost £7. 3s. what will $\frac{6}{1\,1}$ ton cost?

4. Simple interest on \$9000 from March 8 to July 6 at $7\frac{1}{2}$ per cent.

5. Cost of 18 ac. 136 sq. rods of land at \$50 an acre?

6. What is gained per cent. by buying coal by the long ton (2240 lbs.) and selling it by the short ton at the same price?

J

1. $\frac{1}{2} - ·05 + \frac{1}{4} + ·5 - ·025 + \frac{3}{4} - \frac{1}{8}$.

2. Reduce 83 sq. rods to the fraction of 3 acres.

3. Cost of 3 tons 15 cwt. 10 lbs. at \$12 a ton?

4. A garden 180 feet long by 150 feet wide is surrounded by a tight board fence 6 ft. high. What will it cost to paint the fence both sides at 12 cents per sq. yd.?

5. Interest on \$125 from May 15, 1896, to December 20 of same year at 4 per cent.

6. If I buy at 60 cents a score, at how much a dozen must I sell to gain 40 per cent.?

K

1. How many loads of earth, each $\frac{3}{4}$ of a cu. yd., must be removed in making an excavation 21 feet long, 3 feet wide and 3 feet deep?

2. A man's interest on his money, invested at 6%, gives him \$90 a month. What is he worth?

3. Interest on $500 for 156 days at 7 per cent.

4. Add $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$; subtract the sum from 2 and multiply the result by $\frac{2}{3}$ of $\frac{27}{40}$.

5. A man earning $1.75 a day (10 hours) works on a certain day from 1 P.M. to 4.30 P.M. What will he earn?

6. How many yards of paper 30 in. wide will cover the walls of a room 15 ft. long, 12 ft. wide. 8 ft. high?

L

1. Half the product of two numbers is ·05; one of the numbers is ·0005. What is the other?

2. A farmer sold 24 doz. eggs at $22\frac{1}{2}$ cents a doz., and 12 lbs. butter at $27\frac{1}{2}$ cents a lb. He was paid in tea at $87\frac{1}{2}$ cents a lb. How many lbs. of tea should he receive?

3. Value of ·965625 of a mile.

4. If gunpowder contains 75°/₀ of saltpetre, 10°/₀ of sulphur and 15°/₀ of charcoal, how many lbs. of each are there in a ton of powder?

5. The rent of a house is $330, which is 11 per cent. of its value. What is its value?

6. What sum in 10 months at $4\frac{1}{2}$°/₀ produces $3.96?

M

1. A note for $730, dated August 3, payable in 3 mos., is discounted Sep. 15 at 7°/₀. Find the proceeds.

2. In what time will $858 give $128.60 in interest at 6 per cent. per annum?

3. A man invests $\frac{1}{2}$ of his fortune in land, $\frac{1}{5}$ in houses, $\frac{1}{6}$ in bank stocks, and loses the remainder, which was $8000, in speculation. What was his fortune?

4. Find the sum of the third, fourth, fifth, sixth and seventh parts of 32760.

5. Cost of $7\frac{1}{4}$ dozen books at $12\frac{1}{2}$ cents a copy?

6. Find the volume of a square prism if each side of its base is 4 ft. 6 in. and its height 20 ft.

N

1. Cost of 912 lbs. of hay at $14.50 a ton.

2. At what rate per cent. must I invest $600 that in $2\frac{1}{2}$ years it may amount to $705?

3. A man buys 1000 bushels of wheat for $1250. He finds 15% of it worthless. At how much a bushel must he sell the remainder to gain 20% on the cost?

4. I have a sum of money. I deposit 80% of it in the bank and afterwards withdraw 20% of the deposit. $5760 remain in the bank. How much had I?

5. If a bird can fly $12\frac{3}{4}$ miles in $\frac{1}{3}$ hour, how far can it fly in $5\frac{1}{2}$ hours?

6. What will be the cost of painting 8 circular pillars, each 42 in. in circumference and 15 ft. high, at 20¢ sq. yd.?

O

1. What per cent. of $\frac{3}{4}$ is $\frac{1}{5}$?

2. If 200% of a number is $\frac{2}{3}$ of 108, what is the number?

3. A note of $300, payable in 2 months, is dated Aug. 12 and discounted Sept. 1 at 6%. Find the proceeds.

4. Find the difference in time between two places whose difference of longitude is 5° 40′.

5. If I sell wood at $7.20 a cord and gain 20 per cent., what did it cost me per cord?

6. What is the area in acres of a triangular piece of land whose base is 156 rods and height 63 rods?

P

1. A careless pupil subtracted $\frac{7}{8}$ instead of $\frac{8}{7}$. Was the answer too large or too small, and by how much?

2. Cost of 76 bushels 2 pecks 1 gallon of clover seed at $2.40 a bushel.

3. How much must a man's salary be in order that 17 per cent. of it may be $204?

4. Interest on $7300 from March 6 to August 3 at 7 per cent.

5. In what time will $525 give $257.25 simple interest at 7 per cent.?

6. Find the cubic content of a round column of marble whose diameter is 16 inches and height 12 feet.

Q

1. Divide $\frac{1}{3}$ of $2\frac{2}{5}$ by $\frac{3}{7}$ of 1·4.

2. Reduce 1·047 of 2 weeks 5 hours to minutes and the decimal of a minute.

3. If sound travels at the rate of 1125 feet a second, in how many seconds after the flash would you hear the report of a gun fired at a distance of 1·375 mile?

4. Find (by practice) the cost of warming a building for 11 dys. 17 hrs. 28 min., if the cost is $4.50 per day.

5. Find the compound interest on $4500 for 2 years at 4 per cent.

6. Find the circumference and area of a circle whose radius is 2 ft. 4 in.

R

1. From a vessel $\frac{3}{7}$ full 22 gallons are drawn, and it is then $\frac{1}{6}$ full. How much does the vessel hold?

2. Goods are sold for $7\frac{2}{3}$ at a loss of 8 per cent. Find their original cost.

3. Find the number of bricks, 9 in. long, 6 in. wide, 4 in. deep, required for wall 18 ft. long, 1 ft. wide, 6 ft. high.

4. What is the present worth of $1056, due 8 years hence, at 4% per annum simple interest?

5. Take $\frac{1}{4}$ of ·037 from the product of 2·307 and 60·3.

6. Bought oysters at $10 a thousand and sold them 15 cents a dozen. What is the gain per cent.?

REVIEW EXERCISES.

1. How may two fractions be added or subtracted when the numerator of both is 1?

2. How multiply a fraction by an integer? (two ways).

3. How divide a fraction by an integer? (two ways).

4. What are complex fractions?

5. How do weights and measures in the Metric system differ from those in the English system?

6. What is the base of the Metric system?

7. How are names of higher denominations formed?

8. How are names of lower denominations formed?

9. What is the standard unit of length? Of capacity? Of weight?

10. Which units are most used in measuring length? Surface? Volume?

11. Which units are most used in measures of capacity? In weight?

12. For what is the *are* used? The *stere*?

13. How are compound quantities, expressed in the Metric system, added, multiplied, subtracted and divided?

14. What is mensuration?

15. What is a straight line? A perpendicular line? Parallel lines?

16. What is an angle? A right angle? An obtuse angle? An acute angle?

17. What is a parallelogram? Draw, name and describe four kinds of parallelograms.

18. What difference between a square and a rhombus?

19. What is the difference between a rectangle and a rhomboid?

20. What is a triangle? A right-angled triangle? An equilateral triangle? An isosceles triangle?

21. Show by diagram how to find the area of a parallelogram.

22. Show by diagram how to find the area of a triangle.

23. What is a circle? The circumference? Diameter? Radius?

24. How find circumference when diameter is given?

25. How find radius when circumference is given?

26. What is a cube? A prism? A cylinder?

27. What is a triangular prism? A square prism?

28. How find the solid content of a prism or cylinder?

29. How find the upright surface of a cylinder? The total surface of a prism?

30. What does per cent. mean? How is it expressed?

31. How change a common fraction to per cent.? A decimal fraction?

32. In questions on percentage what is the base? The rate per cent.? The percentage? The amount? The difference?

33. How find percentage when base and rate are given?

34. How find the rate from base and percentage?

35. What are profit and loss?

36. What is interest? Principal? Rate? Amount?

37. What is the difference between simple interest and compound interest?

38. What is discount? True discount? Bank discount? Commercial discount?

39. What is a promissory note? The face of a note? The proceeds?

40. When is a note negotiable? When does it mature? How find the discount of a note?

41. For what is circular measure used?

42. What is latitude? Longitude?

WEIGHTS AND MEASURES TABLES.

TIME.

60 seconds (sec.) = 1 minute (min.)
60 minutes = 1 hour (hr.)
24 hours = 1 day (dy.)
7 days = 1 week (wk.)
365 days = 1 common year (yr.)
100 years = 1 century (C.)

CAPACITY.

2 pints (pt.) = 1 quart (qt.)
4 quarts = 1 gallon (gal.)

2 pints (pt.) = 1 quart (qt.)
8 quarts = 1 peck (pk.)
4 pecks = 1 bushel (bu.)

1 pint (water) weighs 1¼ lbs.
1 gallon contains 277 cubic inches.

WEIGHT.

16 ounces (oz.) = 1 pound (lb.)
100 pounds = 1 hundredweight (cwt.)
20 cwt. or 2000 lbs. = 1 ton.
2240 lbs. = 1 long ton.

ENGLISH MONEY.

4 farthings = 1 penny (d.)
12 pence = 1 shilling (s.)
20 shillings = 1 pound (£.)

LENGTH.

12 inches (in.) = 1 foot (ft.)
3 feet = 1 yard (yd.)
5½ yards = 1 rod (rd.)
320 rods, 1760 yards or 5280 feet = 1 mile (mi.)

SURFACE.

144 square inches = 1 square foot (sq. ft.)
9 square feet = 1 square yard.
30¼ square yards = 1 square rod.
160 square rods or 4840 square yards = 1 acre (ac.)
640 acres = 1 square mile.

VOLUME.

1728 cubic inches = 1 cubic foot.
27 cubic feet = 1 cubic yard.

16 cubic feet = 1 cord foot.
8 cord ft. or 128 cubic ft. = 1 cord.

MISCELLANEOUS.

12 units = 1 dozen.
12 dozen = 1 gross.
20 units = 1 score.

24 sheets = 1 quire.
20 quires = 1 ream.

4 inches = 1 hand.
6 feet = 1 fathom.

TROY WEIGHT.

24 grains = 1 pennyweight (dwt.)
20 dwt. = 1 ounce.
12 ounces = 1 pound.

CIRCULAR MEASURE.

60 seconds (″) = 1 minute (′).
60 minutes = 1 degree (°).
360 degrees = 1 circumference.
69⅓ miles = 1 degree.

METRIC SYSTEM.

Money.

100 centimes = 1 franc (fr.)

Capacity.

10 millilitres (ml.) = 1 centilitre (cl.)
10 centilitres = 1 decilitre (dl.)
10 decilitres = 1 litre (l.)
10 litres = 1 decalitre (Dl.)
10 decalitres = 1 **hectolitre** (Hl.)

Length.

10 **millimetres** (mm.) = 1 **centimetre** (cm.)
10 centimetres = 1 decimetre (dm.)
10 decimetres = 1 **metre** (m.)
10 metres = 1 decametre (Dm.)
10 decametres = 1 hectometre (Hm.)
10 hectometres = 1 **kilometre** (Km.)
10 kilometres = 1 myriametre (Mm.)

Weight.

10 milligrams (mg.) = 1 **centigram** (cg.)
10 centigrams = 1 decigram (dg.)
10 decigrams = 1 **gram** (g.)
10 grams = 1 decagram (Dg.)
10 decagrams = 1 hectogram (Hg.)
10 hectograms = 1 **kilogram** (Kg.)
1000 kilograms make a metric ton.

Surface Measure.

100 square millimetres = 1 **square centimetre** (sq. cm.)
100 square centimetres = 1 square decimetre (sq. dm.)
100 square decimetres = 1 **square metre** (sq. m.)

Land Measure.

100 centiares (ca.) = 1 are (a.) 100 ares = 1 **hectare** (Ha.)
A centiare is the same in size as a sq. metre.

Solid Measure.

1000 cubic millimetres = 1 **cubic centimetre** (cu. cm.)
1000 cubic centimetres = 1 cubic decimetre (cu. dm.)
1000 cubic decimetres = 1 **cubic metre** (cu. m.)
In measuring wood the cubic metre is called a **Stere.**

Equivalents.

1 metre = 39·37 inches.
1 kilometre = ·6214 mile.
8 kilometres = 5 miles (nearly.)
1 sq. metre = 1·196 sq. yards.
1 hectare = 2·471 acres.
1 litre = 1·76 pints.
1 hectolitre = 22·01 gal.
1 gram = 15·432 grains.
1 kilo = 2·2046 lbs.
1 metric ton = 1·1023 tons.

Prefixes.

Deca	means	10.
Hecto	"	100.
Kilo	"	1,000.
Myria	"	10,000.
Deci	"	$\frac{1}{10}$.
Centi	"	$\frac{1}{100}$.
Milli	"	$\frac{1}{1000}$.

entilitre (cl.)
litre (dl.)
(l.)
litre (Dl.)
olitre (Hl.)

igram (cg.)
ram (dg.)
(g.)
ram (Dg.)
gram (Hg.)
ram (Kg.)
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